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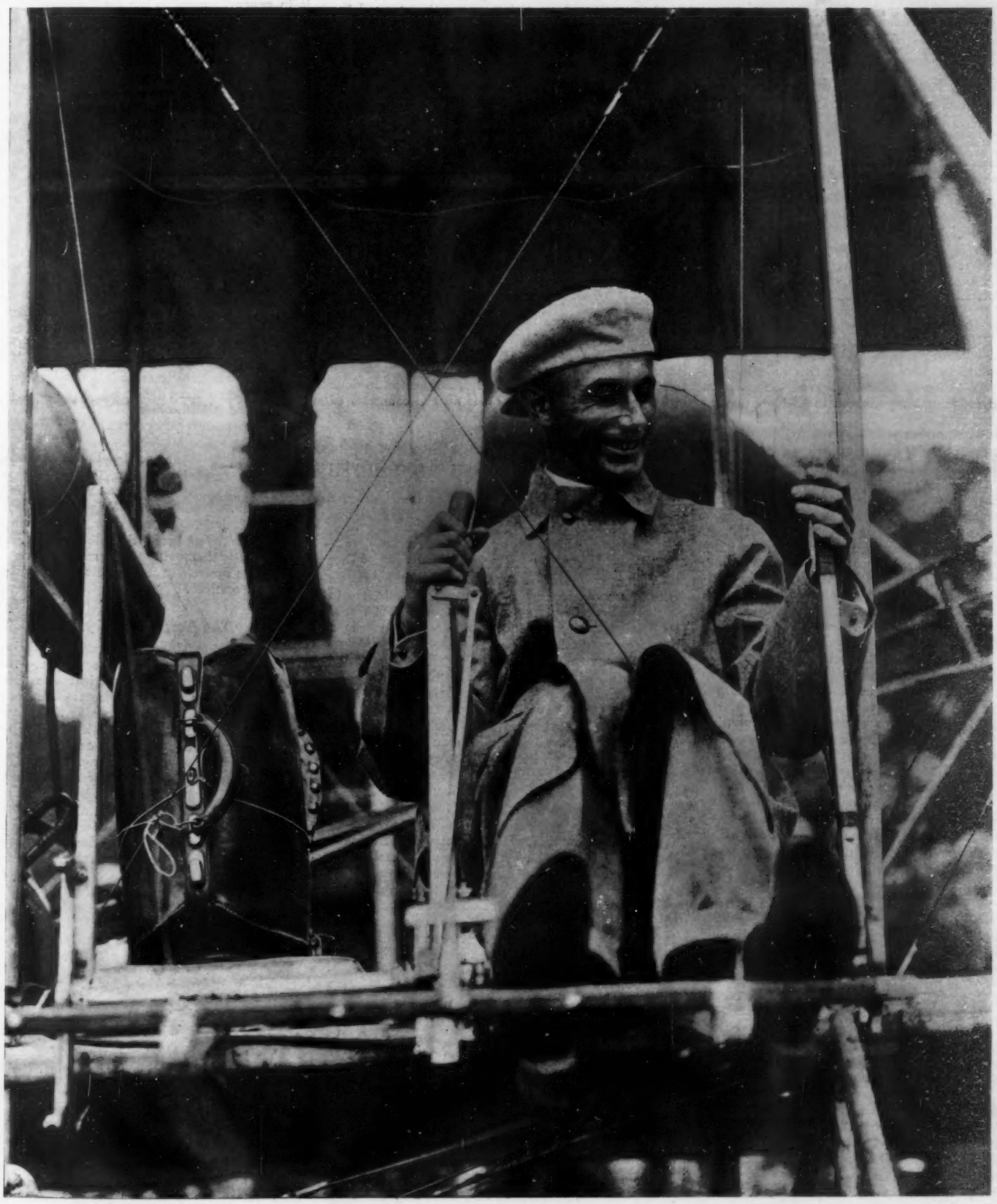

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Atwood in the Aeroplane in which he flew from St. Louis to Chicago and afterward from Chicago to New York.

THE LONGEST AEROPLANE FLIGHT ON RECORD. [See page 225.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The "Oregon" a Prototype of the Dreadnought?

MUCH has been said and written, during this present era of big warships of the so-called dreadnought type, about the astounding but nevertheless continual increase in the size and power of armored ships; but it takes such a concrete presentment as is shown in our artist's comparison on another page of this issue of the old "Oregon" of the United States Navy and the new "Lion" of the British navy to bring home to our minds the amazing development which has occurred during the past twenty years.

Turn back to the newspaper files of the early nineties, in which the naval specialist of the daily press was struggling to express his sense of the almightiness of the "Oregon," and you will realize that there was a common belief that the limit of fighting power had been pretty well reached. And there was much ground for the prevailing enthusiasm; for in 1890, the date of the signing of the contract for the "Oregon," there was no ship afloat that compared with her in the weight of metal which could be discharged in a single broadside.

So great has been the advance in the intervening years that the "Lion," with her speed of from 28 to 30 knots and her battery of eight 13.5-inch guns, could meet the "Oregon" and her sisters, the "Indiana" and "Massachusetts," and sink them without running the risk even of serious disablement. With her superior speed, she could maintain a position so far distant, that the 13-inch shells of the older ships would reach her with a diminished striking energy that would be quite insufficient for penetration of her Simpson armor; whereas at that same range the obsolete armor of the "Oregon" and her consorts would be penetrable by the new 13.5-inch gun.

Comparing the old and the new in detail, we find that the length has gone up from 348 feet to 700 feet, the beam from 69.3 to 86.5 feet, and the displacement from 10,288 to 25,250 tons. The "Oregon" was propelled by reciprocating engines of 11,037 horse-power at a speed of 16.79 knots; whereas the turbines of the "Lion" will probably develop from 75,000 to 77,000 horse-power, driving the great ship at a speed of between 29 and 30 knots. The "Oregon" stowed 1,450 tons of coal in her bunkers; the "Lion" will accommodate 3,500 tons of coal and 1,000 tons of oil fuel. Although the armor on the sides of the "Lion" will be only about half as thick as that on the "Oregon," its resisting power, because of the harder and deeper face, will be greater.

This comparison is made without any thought of disparaging the qualities of the older ship. Indeed, it is worthy of note that the "Oregon" foreshadowed the original dreadnought and all the great ships which have followed her general plan. The European battleship of the early nineties carried four big guns as the main armament, and then dropped into the feeble five and six-inch guns as a secondary armament. The 8-inch, armor-piercing guns of the "Oregon" were a distinct innovation; and it is certainly but just to the naval designers of the United States navy of that day to credit them with having suggested the advisability of an all-big-gun armament as the best suited to the line of battle. The editor, indeed can remember more than one personal discussion of the subject with officers of our navy who protested against the elimination of the 8-inch gun from the "Maine" class of battleships, and urged that the substitution should have been rather of 10-inch guns than of 6-inch for the eights which were carried on the "Oregon."

"The World Patent"

IN speaking before the annual meeting of the Society of German Chemists last June, Dr. E. Kloeppel chose for his subject the "World Patent," and discussed the question of what could be done in Germany at the present time toward the ultimate realization of a universal patent of international validity. While it would be quite unreasonable to be at all optimistic with regard to the early realization in full of such an idea, the speaker pointed out that this is no reason why such steps as are within reach should not be taken to proceed at least some small distance in the direction toward the ultimate goal. Much of what Dr. Kloeppel said is of great interest to the inventor and patent lawyer, and some of the salient points of his address are outlined below.

Dr. Kloeppel first of all pointed out that when we speak of a world patent we tacitly limit our ideas to the countries of the International Union, which of course enter first into consideration. In this connection it is interesting to note a communication published by Damme, that the French government made a proposal at the diplomatic conference of the States of the International Union recently assembled at Washington, according to which all patent applications in the countries of the Union are to be registered at the Bureau in Berne. This plan would be easily carried into effect (as has already been done with regard to trade-marks), if all the countries of the Union followed the French system of patent application without preliminary examination. In view of this it is not surprising that the first detailed publication on the "World Patent" should come from the pen of an energetic opponent of a preliminary examination. Du Bois Reymond opens his book with the declaration that he would look upon a final victory of the preliminary examination process as a "victory of the irrational over the rational." Dr. Kloeppel himself does not follow Du Bois Reymond in this matter, though admitting that the latter's publication contains much which will help to create a receptive spirit toward the idea of the "World Patent," even though its full realization may be a very long way off.

Starting from this basis we may briefly examine what possibility there may be of simplifying the process of examination in connection with patent applications by the aid of international agreement. The chief problem here is to determine how far the actual work of examining, which under the present system is repeated in each country in which an application is filed, could be performed once for all by one country, and the results made available for use in dealing with the applications in other countries.

At the present time England, Austria, Portugal, the three Scandinavian States, Japan, Germany, and the United States have a preliminary examination. As a matter of fact, the objective treatment of the problem of examining differs much less even now in the several countries than is commonly supposed. It is not by any means true that the more important States have the most rigorous examination. Thus, the Scandinavian States have a very strict and thorough examination. Du Bois Reymond proposed that the unnecessary duplication of the examining labor be reduced by the establishment of closer treaties between the individual countries. For instance, the first step might be taken by Germany making an agreement with Austria that all German patents should without further parley be valid in Austria, and *vice versa*. There are, however, considerable difficulties in the way of such a plan, and in fact arrangements of this kind have existed in the past but have been subsequently abolished. The kind of trouble that would be likely to arise can be foreseen if we consider for example the fact that a given patent would be construed by German courts, while it could be set aside only by Austrian authorities.

Another plan which tends in a somewhat similar direction, but could probably be more readily carried out, is suggested by the following considerations:

At a time when Austria had not joined the Paris Convention, and the German-Austrian Treaty of 1891 was still in force, a joint applicant would, as a rule, wait until his German patent was completely examined and issued, and would then apply for a patent in Austria, receiving by the terms of the treaty the benefit of priority in accordance with the date of his German application. So far as can be ascertained, it hardly ever occurred that the Austrian Patent Office—which has a very rigorous examination—refused to grant such patents or even cited new matter against them. It may therefore be said that practically the Austrian Patent Office granted patents on the basis of the German preliminary examination. As a matter of fact, under present conditions, since Austria has joined the Paris Convention, and the German-Austrian Treaty of 1891 has been rescinded accordingly, considerable changes have taken place, and a German applicant is in general forced to file his Austrian application before his German patent is issued, in order to obtain the benefit of the twelve months allowed for priority rights by the Paris Convention. There appears to be no cogent reason why the admission of Austria to the Convention should set aside the previously existing treaty. This latter might therefore be renewed and a clause might be added which would obviate the duplication of the examining work. There would be no occasion for any solicitude that, for instance, the Austrian examination should be less stringent than that in Germany, for in practice this is found not to be the case; indeed, instances are known in which rather the reverse is true. Moreover, any possible error which might arise would be automatically corrected in the subsequent "Einspruchsverfahren" which forms part of the regular procedure both in Germany and Austria in the course of obtaining a patent.

If a treaty of this kind were made first of all between two countries such as Germany and Austria, which are closely related politically and in point of patent law, no doubt the desire would soon be felt among other nations to enter into similar agreements. Possibly when the advantages of such a plan become fully realized, other nations, whose patent laws differ more widely from those of Germany, might be persuaded to take similar steps.

The suggestions made by Dr. Kloeppel are of course framed entirely from the German point of view, and allowance must be made for this in considering them. Possibly, too, they may appear somewhat optimistic. Nevertheless, there can be no doubt that the general principle of such an aim at unification is thoroughly sound and presents an ideal which it is desirable for all nations concerned to set before themselves.

The Term "Anticyclone"

OUR English cousins are never truly happy unless they have some subject—the more academic and unpractical the better—to wrangle about in the daily press. We learn from *Symons's Meteorological Magazine* that a vehement controversy has been raging in *The Times* over the appropriateness or otherwise of the word "anticyclone," which was evolved from the fertile brain of Galton nearly half a century ago, and has since been almost universally applied by meteorologists to a system of winds blowing about a center of high barometric pressure—a "high," as it is called colloquially; the reverse of a "cyclone," or "low."

One correspondent, Mr. Pearsall Smith, suggested that an anticyclone should be called a ***halcyon,*** with reference to the fabled condition of the weather about the time of the winter solstice, when the halcyon was supposed to be brooding on its floating nest. Other writers, whose ideas as to the characteristics of an atmospheric high-pressure area were more or less hazy, suggested such alternatives as "calm," "air-calm," "wind-wyr," and "plenum." The first two of these are interesting as indicating that the English public is quite as much at sea as the American public concerning the proper meaning and application of the word "cyclone." The whole controversy was extremely puerile—and the word "anticyclone" is in no danger of vanishing from the meteorological vocabulary—but it is interesting as an illustration of the discussions of scientific questions by unscientific people that are rather common in English newspapers.

We may suggest that these writers might use their ingenuity to better purpose in trying to devise some acceptable substitute for the word "cyclone" in its application to a cyclonic storm. In doing so they would be following the example of certain German meteorologists who, in the last few years, have endeavored to establish a distinction between the words *"Zyklon"* and *"Zyklone,"* the former meaning a violent whirling storm, and the latter a cyclonic system of winds in general.

Bion Joseph Arnold

An Engineer Who is the Right-hand Man of Public Service Commissions

By Thomas Commerford Martin

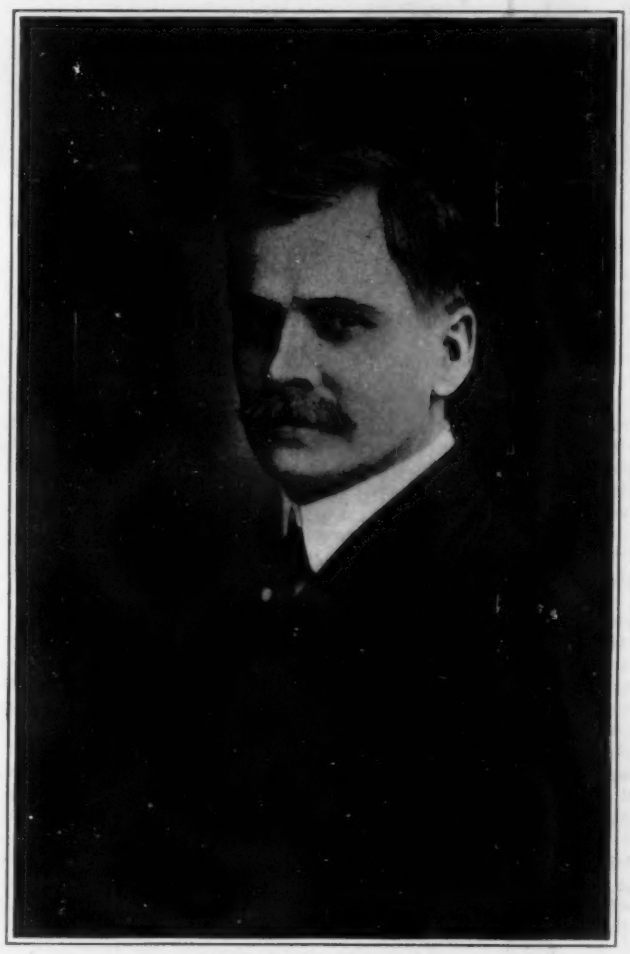
PUBLIC service commissions feed out of his hand. Public service corporations rise up and call him blessed. A court or a master in chancery is perfectly willing to accept his report on the value of a big property, as the basis for rates or new securities; and the banker is ready to accept his verdict in making large investments. There is something fundamentally fair and equitable in his mental make-up that leads to a profound confidence in his trustworthiness and ability, explaining all this. Had he been a lawyer, Arnold would have been an ornament to the United States Supreme Bench, but he would never have filed a minority opinion. He has a profound conviction as to his own inerrancy, but believes that eleven men are more likely to be right than one. Moreover, Arnold would probably never have been satisfied with the income of a judge. Out of clean, straight engineering he makes every year as much as all the bench in Washington put together—more in one year than his father, an able lawyer, made all his life.

The Arnold family began in Rhode Island, so far as this continent is concerned, and records of the eighteenth century show a due profusion of Jeremiahs and Ichabods, which makes one look to the culture of his parent to understand how this man came to be named after a Greek bucolic poet. Anyhow, Bion J. was born at Cazenovia, Mich., August 14th, 1861, but aroused to a consciousness of things American further on westward, for his father had become a pioneer of Nebraska and a member of the territorial legislature of 1865-6. It is something to be among the founders of the great western commonwealths. Nebraska was then rather raw, and there were many struggles and privations for the newcomers on those endless dismal, but fertile stretches of black soil rolling toward the sunset from the banks of the turgid Platte. Young Arnold was never agricultural in his tastes—and, as Edison has said from first-hand observation, hoeing corn has explained the growth of many large cities. But Arnold showed his native bent by devising new types of farm machinery as a boy of six. By the time he was fifteen he had built a piston valve steam engine; when seventeen he built from an advertising cut in the *Youth's Companion* a bicycle, equal to any boneshaker of the period; and a year later he had made a complete miniature locomotive. By this time he had become a student in the Embryonic University at Lincoln, and began spending winters in college and summers as traveling expert for engine companies, or as instrument man with civil engineering parties. He graduated B.S. at Hillsdale College, Michigin, in 1884. M. S. in 1887, and M.Ph. in 1889, but was not satisfied until he had taken a post graduate course at Cornell during 1888-9. It would require some space to record his other degrees and university honors, among them being the Honorary degree of D.Sc. from Amwell Institute in 1909, but Arnold is not unlike many other engineers of distinction who are keen for the fact, but care little for the educational means by which they master knowledge. Arnold's mind is an encyclopaedia of engineering data, but those data are ever too fresh to take on the antique form of erudition.

For several years, Mr. Arnold did odd engineering jobs and lots of constructive work, settling down at last in the electrical field; building as consulting engineer in 1892-3, at the Chicago World's fair, the first electric elevated railroad in the country. He dabbled in storage batteries with engineering and financial success that startled onlookers; and then developed much of the modern electric railway practice, including the pioneer A. C. and D. C. railway between Chicago and Milwaukee in 1897-8 and the pioneer single phase line in 1900-4 at Lansing, Mich. All this involved invention, creative ability, engineering skill and personal courage of a high order—and at the end of a very short period Arnold had lifted himself to leadership in the new profession, ready for the next development.

Every student of invention and engineering knows that while the last century was taken up chiefly with the inventions that have given the world its modern public utilities, neither the promoters nor the public were very acutely alive to the tremendous facts that now arrest attention universally—the political, economic and sociological relations of those inventions to the real welfare of the people. The awakening has been sudden and recent. We were all part of that formative regime, sharing and condoning, but we shall never go back to it, necessary and inevitable as it all was in the creation of the civilization of to-day, based so largely on inventions and arts unknown a century ago.

The chief danger now is that in the recoil of the public mind from what it once advocated and accepted so freely, vital injury may be done to the industries upon which the convenience and comfort of all depend, by reason of the restrictions placed upon the free play of individual genius and upon the opportunity offered to capital. Here comes in the vast significance of Arnold's work in what may be called his later style. He



BION JOSEPH ARNOLD

is arch adviser to the regulating and supervising bodies called Public Service Commissions, and has found a function of extraordinary usefulness in formulating the rules of the new game, in showing what is fair play, in getting a square deal for the public, in insisting upon the right of the investor to a reasonable return on the money which has helped make possible some service that crowded populations have greatly needed. Now Arnold has all the qualities of a real umpire, and might even win popularity on the baseball diamond. He knows himself, from experience, the tears and blood wrung from an inventor in reaching the goal. He has shared in the risks and discouragements of a new industry. He has helped to administer properties and knows the portentous seriousness of the problems confronted. On the other hand his temperament is judicial, his sympathies are broadly democratic, he believes that the public very often has had more coming to it than it was allowed to get under the old régime, and he is first, last, and all the time a staunch and eloquent upholder of the doctrine of the vigilant but fair regulation of utilities working under public charter and enjoying public concessions of one kind or another.

For five years Mr. Arnold was a member of the Electric Traction Commission that banished the steam locomotive from New York city and brought in the glad new era, with work running to an expenditure of $60,000,000. In 1902 he was engaged by the city of Chicago to help rehabilitate its old traction system and devise new ones. This meant valuations and studies on a gigantic scale, and since 1907, Arnold has, under direct ordinances, been chief engineer there, controlling construction operations that aggregate a cost of $65,000,000. About the same time he had charge, as consulting engineer of the electrification of the Sarnia tunnel of the Grand Trunk railroad and was a member of the Commission to prepare plans for electrifying the Erie Railroad. In 1908, as consulting engineer to the Public Service Commission of the First District of New York State he made a brave essay to solve some of the mighty problems involved in the operation of the congested Interborough subways, and many of his recommendations, such as side doors for cars, speed control signals, lengthened station platforms, etc., have since been adopted resulting in great increase of capacity and earnings. With this went a lot of appraisals for the Commission of all the surface railways. In 1910, he made an intensely interesting report on the traction conditions of Pittsburgh and during the same year was appointed chief subway engineer for Chicago, preparing a report presented last February. This year he has made for the city authorities of Providence, Rhode Island, an elaborate study of the local transportation needs; and at the moment is engaged in sizing up the complicated situation at Los Angeles, Cal., where all kinds of traction services have to be tied in and coördinated for better results to traffic and commerce. These and other such jobs are large sized propositions for a big man, but Arnold measures up to them very comfortably.

While his reports are masterly in their exhaustiveness and models of completeness, Mr. Arnold's speeches and addresses when he lets himself go, are breezily western and none the less delightful. He can't help thinking clearly. As president of the American Institute of Electrical Engineers and of the Western Society of Engineers, his executive talent shone to great advantage, and as a member of many societies, clubs and civic bodies he is loyal, generous and ever companionable.

Illuminating Pistols in the German Army

DURING the recent extended maneuvers of the German army there were many night attacks; in which use was made of the newly introduced illuminating pistols. According to the new regulations, these are to be employed wherever the configuration of the land makes their use preferable to that of the ordinary search light. The machinery necessary for the use of the latter device is very inconvenient, and especially in rolling and otherwise difficult country, where the main maneuvers take place, it cannot be used to advantage. The illuminating pistols have not this disadvantage, as they are easily transported. Further, the searchlight is useless in valleys and deep-lying plains, as their rays shoot over these and leave them apparently in still deeper shadow. For this reason, such valleys serve as excellent covers at night, against the searchlights. The illuminating pistols have done away with this advantage of shelter, as the cartridges which they throw light up the deepest and darkest gulleys.

There are two different sorts of cartridges, producing respectively white and red light. The white ones serve exclusively for illuminating the country, the red ones for signaling purposes between widely separated commands or divisions, even where the distance between them is several kilometers. The illuminating cartridges develop a light that makes everything within 200 meters (656 feet) visible, and lasts eight to ten seconds.

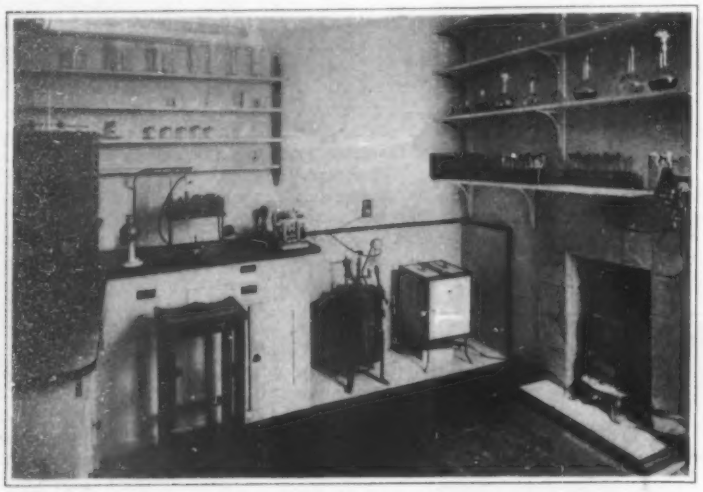
An English Plea for Aerial Navigation

THE Aerial League of the British Empire held a meeting at the Mansion House on May 24th, at which it was decided to inaugurate a special coronation appeal for $1,250,000 for the establishment of a national institute and school of aeronautics.

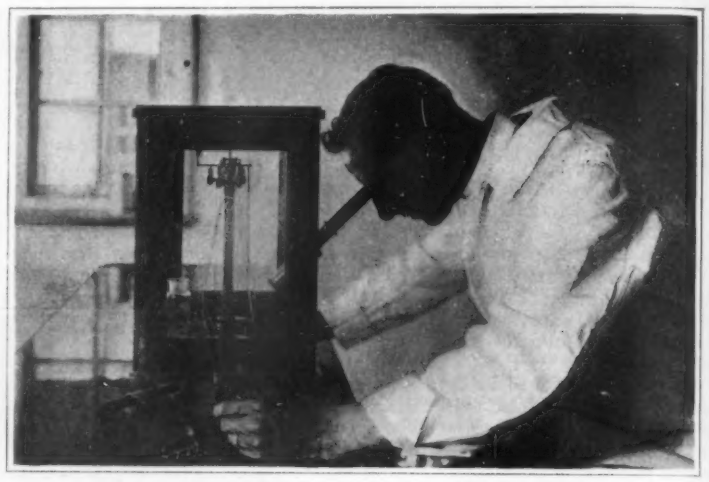
The Opening of the Radium Institute in London

A Red Letter Day in the Annals of Medicine

IT will be remembered that the late King Edward took a keen personal interest in the advancement of cancer research, and that he was also an enthusiastic supporter of the movement for the establishing of a special radium institute in the metropolis, where the study of the application of radium for the cure of cancer and for other therapeutic uses should be carried on. The realization of this institute became possible through the generosity of Viscount Iveagh and Sir Ernest Cassel, and the official opening of the new establishment took place on August 14th.



A corner in the physical laboratory of the new radium institute.



This balance weighs to one thousandth of a milligramme (about one hundred-thousandth of a grain).

The radium institute is equipped with all the modern appointments required for successfully carrying on what promises to be one of the most important branches of medical research. Our illustrations give only a few samples of some of the special apparatus installed. The most important asset of the institute is of course its stock of radium, amounting to 1 gramme and valued at $75,000. Among the special instruments of the institute may be mentioned a very fine chemical balance which weighs to one-thousandth of a milligramme (about one hundred-thousandth of a grain), and a very remarkable microtome, or microscope-section cutter, which will make no less than 25,000 slices from one inch of material. Its extreme fineness has been graphically described by saying that it would cut a blood corpuscle into eight pieces.

The application of radium for therapeutic purposes is still in its infancy, but some of the results obtained are most encouraging, and the present juncture seems a fitting occasion to pass in brief review some of the principal methods employed and effects observed upon the healthy and diseased organism.

Radium rays have an unmistakable bactericidal action, both in artificial cultures and within the organism. As may naturally be expected, the effect increases with the amount of radium, and the three kinds of rays, the alpha, beta, and gamma rays act in proportion to the extent to which they are absorbed, the highly penetrating gamma rays being least effective. A rather peculiar effect has been observed in the case of luminous bacteria, a small mass of radium contained in a luminous bacterial culture appeared surrounded by a small dark area, due presumably to bactericidal action. Immediately surrounding this dark area is a ring of increased brightness. The cause of this stimulating effect is unknown. According to some observers, radium rays diminish the virulence of rabies toxin, but Wanysz found the rays ineffective when applied to a fresh preparation of the spinal cord.

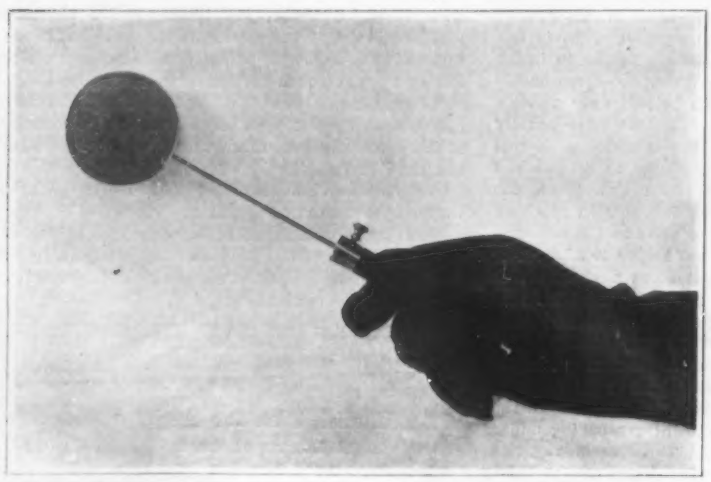
As regards the medical application of radium treatment, this has hitherto extended principally to skin affections, ulcers, tumors and cancers. In the treatment of vascular tumors the radium salt is mixed with finely powdered barium sulphate, and spread with varnish in a thin layer on a metal plate. This is conveniently mounted upon a handle, and then presents the appearance shown in our illustration. The treatment, as described by A. C. Jordan in a review in *Nature* of Prof. Gaucher's book on Radiography, consists in the application of this disk to the diseased portion, the dose being regulated according to the form and extent of the tumor. Another method is to give smaller doses filtered through screens which absorb the less penetrating rays, longer exposures being in this case given. The results obtained are very satisfactory, and on the whole, better than those secured by any other means. In the treatment of scar tissue tumors very favorable results are obtained both by X-ray and by radium treatment, but radium is less liable to cause inflammatory troubles.

The activity of radium is usually expressed in terms of that uranium. If the latter be taken as the unit, the activity of pure radium is two millions. In mixtures of radium and barium salts, the activity of the mixture is inversely proportional of the quantity of the barium salt present. In the treatment of cancerous tumors, preparations of an activity of 500,000 are used, consisting usually of four to ten milligrammes of powder containing one part of radium salt to three of barium salt. Cancers suitable for radium treatment range from those of small size to those of 20 to 30 square centimeters in area.

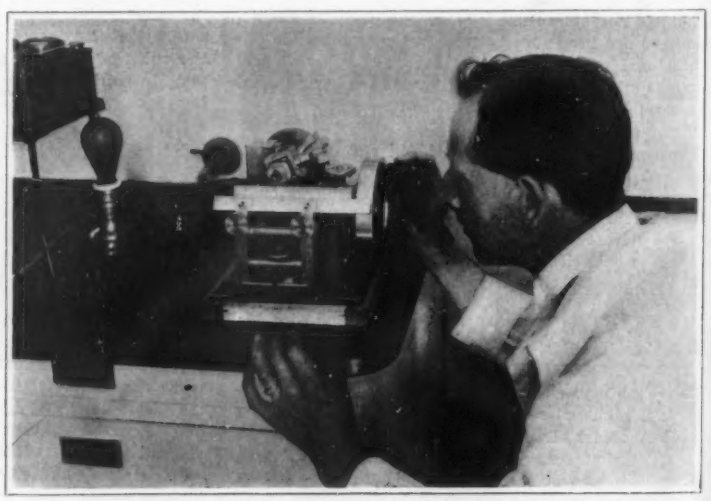
Deep-seated cancers are subjected to a special treatment, the rays being filtered by passing through a thickness of lead ranging from one-half to several millimeters. This permits only the highly penetrating rays to enter the tissues. Long exposures varying from 24 to 120 hours are given. It is found that the highly penetrating rays produce very little change in the healthy cells, while they have a selective action upon the cancer cells, causing their destruction. The progress of a successful case is described by Mr. J. Jordan in the review quoted as follows:

"After a short time (three to eight days) the tumor commences to diminish in size. Cicatrisation then begins and is completed in two to four weeks, or longer in obstinate cases. In the case of ulcerating tumors, a certain amount of discharge occurs during all the stages. For large and deeply-extending tumors the method of 'cross-fire' is usually employed, two or more radium apparatus being applied at different points around the tumor in such a way that the ultra-penetrating rays cross in the depths of the tumor. In this way the deeper parts of a growth can be subjected to the influence of the gamma-rays far more effectively than with a single disk of radium."

In addition to the method of treatment described above, various other modes of procedure have also been proposed and practiced with varying degrees of success. Among these, it is interesting to note in particular the therapeutic use of radio-active baths, inasmuch as the supposition naturally suggests itself that some of the natural waters famous for their health-giving qualities, owe these to the presence of radio-active substances. This subject has been much discussed, and it will suffice to remark here that probably the action in such cases takes place by inhalation of the emanation arising from the water.



The varnish on this disk contains $4,000 worth of radium.



Minot's microtome—a section cutter which makes 25,000 slices to the inch.

RADIUM IN MODERN MEDICINE

Atwood and His St. Louis-New York Flight

A Record Full of Promise

ONLY a few years ago, Prof. Simon Newcomb, an authority who was quoted the world over, branded the heavier-than-air flying machine as a mechanical absurdity. "I consider the demonstration that no possible combination of known substances, known forms of machines, and known forms of force, can be united in a practicable machine by which men can fly long distances through the air, as complete as it is possible for the demonstration of any physical fact to be," was one of his dicta. He followed it up with the statement: "Let us discover a substance a hundred times as strong as steel, and with that some form of force hitherto unsuspected, which will enable us to utilize this strength, or let us discover some way of reversing the law of gravitation, so that matter may be repelled from the earth instead of being attracted to it, and then, and not till then, we may have a flying machine." To drive home his conviction as far as possible, he concluded: "There is every reason to believe that mere ingenious advances with our present means and forms of force will be as vain in the future as they have been in the past."

What would Prof. Newcomb say if he were now alive? What comment would he make on the flight of a young man from St. Louis to Chicago and from Chicago to New York in a machine that did not involve the discovery of new forces or material, in a machine which was as subject to gravitation as a thing of metal and wood and canvas can be?

It may be said that Atwood's performance unquestionably proves that the flying machine has a future for swift transportation, when speed is more to be considered than cost. Atwood assures us that his expenses were $900 a day. Even if they were but a tenth of that, only a Wall Street banker who must travel from his office to Chicago swifter than a railway train can now carry him, and then because millions are perhaps at stake, can afford to pay such an exorbitant price for the transportation of his brains to the spot where they are needed. On the other hand, there is every reason to believe that so long as men like Atwood, Beaumont, Vedrines, and other present day champions of the air, race for purses that hold thousands of dollars, no attention will be paid to reduction of operating costs. When the public has wearied of aviation meets (and there is evidence that in Europe at least the cross-country flight has completely displaced performances in an inclosure for the benefit of thousands in the grandstand and on the field), when newspapers have extracted all the notoriety they can by offering huge sums for successful flights between cities remote from one another, the engineer will step in and provide us with machines and engines that will transport us through the air at a cost no greater than that of a present-day automobile tour. So long as $900 a day is the cost of a flight from Chicago to New York, so long will the aeroplane be the exclusive property of aerial performers with itching palms.

In last week's SCIENTIFIC AMERICAN, we commented editorially with such fullness on Atwood's historic flight that we can do little more here than to call attention to its more salient features. In the first place, it must not be forgotten that Atwood started from Chicago after a 286-mile flight from St. Louis, made in one day at a speed of 46¼ miles per hour. That he should have flown day after day with but one mishap, speaks well for the aeroplane, although we suspect that inasmuch as the type of machine with which his victory is identified has been in existence for over a year, a large part of his success must be attributed to personal skill. To him belongs the distinction of having made the longest continuous flight on record, covering, as it did, 1,265 miles in a total flying time of 29 hours and 35 minutes, corresponding to an average speed of 42.76 miles an hour.

Of his experiences in this remarkable jaunt he says: "My only trouble in all the 1,265 miles was a stalled motor. Think of the spots where I landed. At Lyons, N. Y., it was on top of a hill; at Amboy, west of Syracuse, it was in a marsh; at Fort Plain it was in a rocky meadow, upon the top of a mountain; at Castleton it was on a steep slope along the bank of the Hudson; at Glen, where I stopped to make repairs, it was on the top of a mountain 1,250 feet high. At Cold Spring, across from West Point, I had to climb the side of another mountain, and landed right plump on the top ledge with only a ten minutes supply of fuel."

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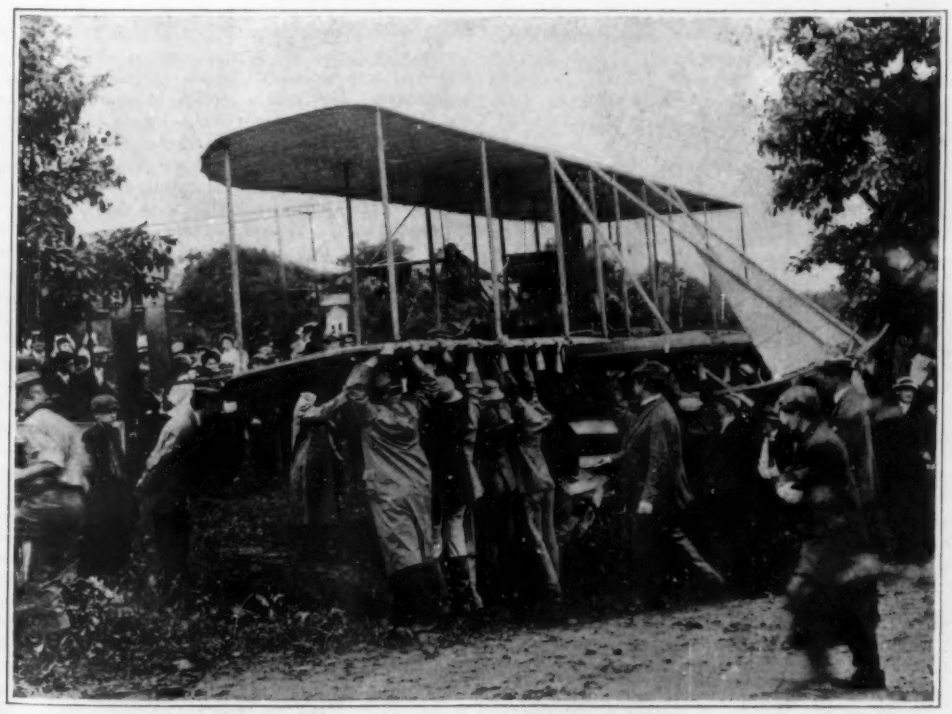
Atwood landed at Nyack in a small field from which he could not start.

Atwood accomplished his journey in 20 flights of an average of 63¼ miles each, with but a single forced descent at Nyack. A less steady hand, and poorer judgment might have wrecked the machine at that particular time; for Atwood alighted on a piece of ground so small in area that it was impossible to start from it after the necessary repairs had been made to his motor. As it was, a few trees had to be removed and his machine had to be carried bodily to a position more favorable for starting. His Nyack mishap drives home the inevitable truth that the motor is the most vital part of the aeroplane. Until engines are absolutely reliable the aeroplane can hardly become the popular pleasure vehicle except when fitted with floats and flown above water courses where it can alight safely in case of accident.



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Carrying Atwood's aeroplane to a more favorable starting place.

ATWOOD AND HIS ST. LOUIS-NEW YORK FLIGHT

A Competitor for the Trans-continental Flight

ONE of the recent graduates of the Wright school at Dayton, Mr. Robert G. Fowler, of Los Angeles, Cal., has entered the trans-continental race for the $50,000 prize offered by a New York newspaper.

The rules require that notice of the entry be given two weeks before the start, that the journey must be made in 30 consecutive days, and that the start must take place before the 10th of October next. The flight may be made in either direction. Mr. Fowler has decided to follow the northern route of the Southern Pacific railroad, since by so doing he will not be obliged to fly over such long desert stretches and will at no time be over 50 or 75 miles from a town or village. The total distance over the desert amounts to 335 miles. It is planned to have a special train accompany him carrying three extra motors and complete machines. The most dangerous part of the trip is the 75 miles across the Sierra Nevada mountains from Colfax, Cal., to Reno, Nev., and the 57 miles across the Rockies from Laramie to Cheyenne, the elevations reached in these two places being, 7,014 and 8,010 feet. The railroad runs along the mountain side many miles through snow sheds, and a landing without disaster would be an impossibility throughout these stretches. Nevertheless, Mr. Fowler hopes to have as good luck as did Vedrines in flying over equally dangerous country in the Paris-Madrid race, and the route he has chosen gives him a saving in distance of 1,800 miles over the southern route, the total distance by rail being but 3,210 miles.

Scientific Developments in Aerial Navigation

Army Aeroplanes; New Air Maps; Submarines and Aeroplanes

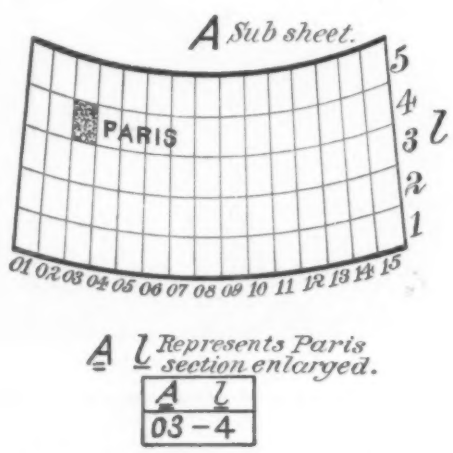
Army Aeroplanes in France

THE question of organizing an aeroplane service for the army is occupying much attention in France at present, especially in view of the coming military maneuvers which will take place in the fall. M. Messimy, the new Minister of War, is taking active measures to make use of aeroplanes in the best possible way. The maneuvers will no doubt bring out many useful points, and at the same time will give some further data for organizing an aeroplane corps for the army. Steps are already being taken to do this. One plan is to have a reserve aeroplane corps which does not belong to the active army, but can be called into requisition when it is needed. Last year a number of pilots were called upon for an aeroplane service in this way, among others Latham, who then resumed his army position of lieutenant, and Breguet and other pilots acted in the same way. This year will see a greater number of well known pilots who have made their records within a recent time, among others Vedrines, and they will take part in various operations during the maneuvers. In principle, the pilots go through their annual period of 28 days which is required of all private citizens up to a certain age. They will therefore not receive any money compensation, but will be rewarded by honorary distinctions or rise in grade. It will be remembered that Latham, Leblanc and others already received decorations owing to their performances in the military service. A point to be considered is how to recruit the aeroplanes themselves. The Minister considered at first that this could be done by having one or several aeroplanes kept in hand by each constructor so that they could be called upon for use in the army in case of need, and the constructor would also furnish the pilot, receiving an annual premium of $1,000 for the aeroplane. However, this plan has its drawbacks, as we find that aeroplanes are being quickly improved at present, and they would likely be out of date very soon. This reason led to considering another plan, that is, a requisition of the aeroplanes from their owners, such as has already been decided upon for automobiles, and as each citizen is already considered as nominally belonging to the army, it is natural that he should bring his machine into service at the same time should this be needed. At all events, whatever may be the plan adopted, it is certain that active measures will be taken to organize the aeroplane corps. On the other hand, the Navy Department is taking steps in the same direction. M. Delcassé, the new Minister of the Marine, considers it best to take the pilots which are trained by the War Department in its various establishments, in order to avoid multiplying the number of training grounds. The Navy Department will then proceed to purchase the aeroplanes which it needs. Commandant Daveluy, a prominent naval officer, is already appointed as chief of the aeroplane service, and he formerly distinguished himself by his treatises on naval tactics. The headquarters will be at the naval port of Toulon where is stationed the Mediterranean fleet, and aeroplane grounds have been already laid out near the naval docks. We already mentioned that aeroplanes are to be one of the features of the next naval maneuvers, and they will be used in connection with battleships and submarines. Now that Aubrun found that he could sight a submarine when under water, this will no doubt be made one of the features of the maneuvers, and some interesting results may therefore be expected.

An International Aero Map

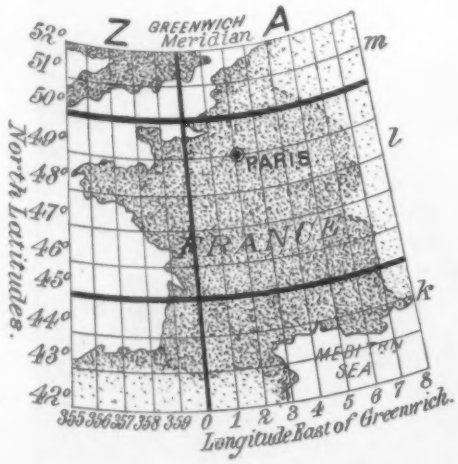
By Our Paris Correspondent

WITH the modern progress of aeronautics, and especially with the coming of the aeroplane, the need of specially adapted maps to serve as a guide to airmen has become strongly felt. What is wanted is essentially a clear and thoroughly readable map from which the pilot can gather everything he needs, while all unnecessary and confusing detail is omitted. This, however, is not enough. We must have large conspicuous signals laid down on the ground and on the roofs of buildings. Prof. Alphonse Berget, the noted Paris scientist, the head of the department of Physical Geography at the University, gives the following account of the recent meeting of the delegates of the International Aeronautic Federation, which assembled at Brussels to discuss these questions. The chair was taken by Prince Roland Bonaparte and all the leading countries were represented. America sent Mr. Edgar W. Mix; the German representatives were Mr. Hiedemann of Cologne, and Dr. Berson, the holder of the world's altitude record, Commandant Von Frankenburg and others. The Austrian delegates were Commt. Th. Scheimpflug and Dr. Peucker of Vienna. Belgium was represented by Col. Jeanne, Mr. F. Jacobs, President of the Aero Club, and others. Among the French representatives were, in addition to the chairman, Prof. Berget, Mr. Serven and others. It was decided from the beginning to deal separately with the two questions of the map and the ground signals, equal importance being attached to each. The subject of the map was taken up first, and, thanks to the friendly feelings and unity of views which prevailed at the meeting, excellent progress was made. It was decided that each country should prepare an aeronautic map upon a standard scale of 1:200,000, and further that the map of each country should be sub-divided and cut up into small sections corresponding to degrees of latitude and longitude. The longitudes are numbered from the Greenwich meridian and the latitudes from the equator.



The Paris sub-section showing the method of designating the sectional parts.

The French map will be drawn up along the general lines laid down by Commt. Talon. This method has been adopted by the Aero Club on account of its great clearness, after consultation with some of the leading experts. France will be divided into 75 sub-sheets, each measuring 16 x 24 inches. These sheets will be laid out according to the poly-conic projection method previously adopted for the 1:100,000 map of the Department of the Interior and also for the world map. To facilitate the proper assembling of the sub-sheets, they will be grouped together in a large rectangle, and each rectangle will be indicated by two letters. A capital letter denotes the longitude. The letter "A," for instance, includes the section lying between the meridian at Greenwich and 8 degrees east longitude. The small letter on each sheet refers to latitude, one sheet taking in five degrees. Thus, for example, the sheet "A l" takes in the greater part of France and includes a number of sub-sheets. All the sub-sheets bear the letters "A l." The main sheet is divided into seventy-five sub-sheets, each including one degree of longitude and five degrees of latitude and carrying at the bottom a number from 1 to 15 for longitude and at the side a number from 1 to 5 for latitude. Thus the sub-sheet upon which the city of Paris shows is designated A l 03.4. It is these sub-sheets, measuring 16 x 24 inches, which the aeronaut will carry with him on board. Each country is to draw up its own maps with reference to this general plan, but is at liberty to choose its own method of indicating the details, except that electric power lines will be shown by lines of red crosses.



General view of aero-map of France.

As regards the second point under discussion, namely, the ground signals, it was decided that the matter could not be properly dealt with until more experience had been gained with different kinds of signals.

Submarines and Aeroplanes

SOME very interesting experiments have just been carried out in Cherbourg, test the capabilities of an aeroplane in detecting and locating submarine craft. The aviator who flew the machine in these tests was Aubrun, the well-known champion, who volunteered to give his services, saying that he was convinced that he could sight a submarine even when submerged at some depth from the water. The machine he used was a Deperdussin. A series of experiments was organized in which two torpedo boats and two submarines took part, as well as a steam tug designed to take the aeroplane. All the trials took place on one day, with a light wind and calm sea, and comprised two different sets of experiments. In the first set, the aviator was told the approximate location of the submarines. Aubrun had no difficulty whatever in locating the first submarine, which was partly out of the water. On the approach of the aeroplane it plunged and disappeared. The aviator then went in search of the second submarine and located it under water at a distance of about two miles from the first. During these trials, which took place about three miles out at sea, Aubrun rose first to 500 feet and then flew at a thousand to twelve hundred feet. The second trial was more difficult, but lead to complete success. In this case no indication whatever was given as to the location of the submarines, which were submerged under water. Aubrun made a fresh start from the ground and then rose to a height of about one thousand feet, sailing in large circles of 1,500 to 1,800 feet diameter over the sea. The sun was very low by this time, making it harder to view the sea bottom. Before long Aubrun discovered the light reflected from a periscope, and after that it was a comparatively easy matter to locate the submarine, which appeared as a black mass moving at about 20 feet depth. Auburn then returned to the ground after having been up about 20 minutes. It appears to be now beyond question that an aeroplane flying as high as 3,000 feet from the earth can detect a submarine, while on the other hand the periscope of a submarine will not give a recognizable image of a flying machine at more than 1,500 feet. However, it is not altogether an easy matter to locate a submarine when the aeroplane is flying high, and the pilot must be specially trained for this work. In view of the very favorable results obtained so far it is intended to continue the trials which have been begun. For the purpose of locating submarines and torpedo boats probably a rather slow aeroplane flying at about 50 miles an hour is quite sufficient. On the other hand for scouting purposes a very rapid flyer is needed. What is particularly wanted at the present juncture is a set of maneuvers in searching for submarines lying at a depth of 60 to 100 feet under water, the aeroplane flying at different heights, and under conditions both of still water and rough seas. Floating mines also are to be searched for, and combined maneuvers, in which battleships, torpedoes, submarines and aeroplanes take part should form part of the programme. When the aviator has discovered a submarine, he discloses its location to a torpedo boat by dropping a buoy into the water.

The Population of London

ACCORDING to the latest census returns for the administrative county of London, the total population for Greater London is 7,252,963. The area of the administrative county of London is 116.8 square miles. The area of Greater London, which includes all parishes within 11 miles of Charing Cross, is 693 square miles. In 1910, the five boroughs of New York boasted of 4,776,883, although the population is now estimated at more than five million.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Wolf's and Brook's Comets

To the Editor of the SCIENTIFIC AMERICAN:

The following observations of Wolf's and Brooks's comets, respectively 1911 *a* and *c*, were made on the evening of August 20th, 1911, with the aid of the 40-inch refractor of this observatory.

Wolf's comet first observed; very apparent in the 40-inch, and in a rich field. Small. Slight indication of a nuclear condensation. Near a small star.

Brooks's comet was observed, first with the 4-inch finder of the great telescope. The nuclear condensation was a little more apparent than on previous evenings, but the comet was generally about the same. Secondly, with the telescope: The nucleus and matter extending in all directions from it were all that were visible at one time, on account of the size of the field of view; the former, however, presented a fairly large disk and was nebulous in appearance. The light of the nucleus was practically white. There were several comparatively bright stars in the same field, which were actually visible through the head of the comet, apparently undergoing no loss in brilliancy whatsoever. The field itself was very luminous, and in some parts the nebulosity was more apparent than in others, which fact indicated the presence of a tail extending out into space, beyond the head of the comet. FREDERICK C. LEONARD.

Yerkes Observatory, Williams Bay, Wis.

A Merchant Marine Suggestion

To the Editor of the SCIENTIFIC AMERICAN:

I wish to express my appreciation of your Merchant Marine number. I have read each of the five articles twice and find them great educators. But I note with sadness that your lay readers, the common people of the United States, upon whom rests the duty of deciding this whole matter, are not taking advantage of your invitation to discuss this problem as it should be discussed.

To them I wish to say, The trouble lies with *you*. Your Congressman is afraid of your vote. Therefore he balks and actually delays the working out of the destiny of the greatest nation on earth. It is up to you, you and Bill and John, to get busy and study this problem and make your wishes known. And it is a glorious problem. Try it!

To me the five Merchant Marine articles mentioned have been a means of evolution in my own ideas; and in view of the great importance of this problem I am offering my third letter on the subject, hoping that you may thus be led to see how easy it is to get into print in a really worthy periodical and on a gloriously patriotic subject, *and to try it for yourself*.

After careful consideration I believe that the following plan would the most effectually accomplish every desired result and meet every worthy objection.

In order to get our just share of our commerce with each foreign nation, viz., one-half of it, without the payment of a single dollar in subsidies or the remission of a single dollar in duties, let us negotiate treaties with other nations for an equitable division of the carrying trade between each foreign country and our own, to the exclusion of vessels of all other foreign nations.

Thus, taking Brazil as an example, let American vessels loaded at home for Brazilian ports secure Certificates expressed in figures based upon the amount of cargo carried multiplied by the number of miles to be traveled. The same vessel, if after unloading in a Brazilian port should reload with a Brazilian cargo for an American port, would receive similar Certificates from the Brazilian authorities. Both of these Certificates would then be exchanged for Receipts, the Brazilian government holding the Certificates and the American ship the Receipts. These papers might be entitled American-Brazilian Merchant Marine Certificates and Receipts. In exactly similar manner Brazilian vessels plying between Brazil and the United States would receive Brazilian-American Certificates which would be exchanged with the American authorities for Receipts.

The American vessel, upon its arrival home, would exchange its American-Brazilian Receipts for Brazilian-American Certificates, the latter having been obtained by our government as evidence of traffic carried on by Brazilian vessels in exactly the same manner as the Brazilian government obtained American-Brazilian Certificates. The cancelation of the Receipts received by our government would conclude this part of the process.

On the next and succeeding trips the American vessel would go through exactly the same process except that it would be required to surrender to the Brazilian government Brazilian-American Certificates in amount corresponding to the amount of traffic in which it would be engaging on that trip. Of course, Brazilian vessels would be accorded exactly similar treatment in American ports.

Prohibitive duties, then, upon vessels of any other nation than the United States or Brazil and on vessels not presenting the Certificates would keep out all interference and leave the carrying trade between the United States and Brazil to be exactly divided between the vessels of the two nations. For no American vessel could profitably engage in the trade unless some Brazilian vessel had engaged in an equal amount of the carrying trade and thus produced the necessary Brazilian-American Certificates. Likewise, Brazilian vessels would depend for their profit upon the existence of American-Brazilian certificates obtainable in their home ports for use in our ports on the succeeding trip.

Similar treaties could be made with as many nations as might care to enter into them, and it would certainly not be difficult to find or create sufficient inducements to the ratifying of such treaties by any nations with which we might wish to carry on trade. To me this plan seems so simple and effective and so free from all possible objections as to be worthy of a trial. At any rate I hope you and Bill and John will get to work and see if you can't devise a better plan.

Hettinger, N. D. N. J. NOBLE.

Rainfall and Parasites

To the Editor of the SCIENTIFIC AMERICAN:

On page 391, issue of June 24th, you publish an article, "Rainfall and Parasites."

I am a veterinarian, with a penchant to investigation of subjects relating to my branches. These parasites require humidity, often ground covered with water, so go through the different stages of their complicated life-cycle, is well known and understood. It is unfortunate that careful statistics are not kept in this country regarding the increased loss from this source, and we must refer to European statistics to study this problem.

Some years ago Dr. Hutchison, meat inspector at Portland, Oregon, by careful observation found out that cattle and sheep from overflow districts where carp were numerous, were free from liver flukes (*Distornum hepaticum* or *Fasciola hepatica*). The carp is a good scavenger, and destroyed the flukes during their water stage or destroyed the water snails that were the hosts, during a certain period of the *Cercariae*.

In the nineties I was in practice on the coast of Oregon, in Coos County. There we suffered losses from *Distornum hepaticum*, especially after wet seasons, when the bottom lands had been under water and were used as pasture soon afterward. Lungworms also killed many sheep and calves. The life-cycle of *filaria pulmonalis* is not known.

After many experiments—attempts to cure the affected animals—it occurred to me that to prevent would be more rational. Clean the pastures. How?

Ducks, geese. A flock of ducks and geese will go over a good deal of ground, and destroy all forms of animal life. No doubt large tracts could not be "cleaned out" in this manner, but I remember two ranches on which, after two years of systematic running of ducks, the calves remained healthy, and the sheep were free from lungworms. This latter fact was noteworthy, because the life-cycle of this parasite has not been worked out.

Some years ago, when at the veterinary department of the University of Pennsylvania, I mentioned these facts to Prof. C. F. Marshall, and he fully indorsed my statements, although he had never had opportunity to put the idea to actual test.

The keeping of water fowl, especially ducks, is indicated in game reserves. Ravages of *Distornum hepaticum* among elk, moose, deer, are common, and the ponds are infested before we know the cause and the losses appear. But if some quarters are provided for ducks and swans and geese (they may be ornamental, although Indian runners are best) and their breeding favored, they will destroy many injurious forms of life that—no doubt about it—are necessary to permit a complete life-cycle of several parasites. This has been worked out in the life-cycle of the flukes (water snails—*Cercariae*); observations that I made during several years led me to assume that the same means also prohibit the development of *strongylus filaria* and similar parasites (*ovis pulmonalis*) in sheep and cattle and hogs.

Would you tell me from what paper of Prof. M. G. Moussu your article "Rainfall and Parasites" is a *résumé*?

At present I am on the staff of the local department of health and sanitation, and am therefore interested in rational prophylactic measures. I always read your valuable publications.

Tacoma, Wash. C. H. SCHULTZ, M.D.V.

The Left-hand Mold-board

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of June 17th a patent office examiner expresses surprise at seeing so many plows in the West with left-hand mold-boards.

When I was a boy—I am now sixty-four years old—only the right-hand mold-board was made. In the last thirty or forty years, I have not seen one.

The advantage of the left-hand is that the leader walks in the last furrow made, and the off or right-hand horse on the unplowed ground, so both are on solid ground.

As the leader is usually the larger, this is very advantageous to the off-horse. With the right-hand mold-board the off-horse had to pull on soft plowed ground.

You have probably received many better explanations before this will have reached you.

I have had a great deal of interesting and valuable information in the last few years from the SCIENTIFIC AMERICAN, and am glad to reciprocate in a small way.

Taylorsville, Ky. E. D. BOURNE.

Niagara Falls from a New Point of View

To the Editor of the SCIENTIFIC AMERICAN:

It seems that a great deal of valuable energy is being wasted in hysteria over the supposed wanton destruction of Niagara Falls.

We hear great tales of woe, with heavy sob effects, fernint the time when this beautiful cataract shall become a dribble and the wild, rugged gorge shall be but a dirty, grinding workshop where a coterie of millionaires are enabled to pile up further hoards of unearned increment, to the detriment of all "the people."

I hold that whole volumes of this kind of gush can be very easily dispensed with or turned into other channels, without any injury to the body politic.

It seems strange to me that in all this discussion, we hear nothing whatever of the good to come to humanity from allowing this immense falls to work out its board and lodging.

Here we have a force of a sum total of 5,000,000 horse-power not doing one thing but tumbling down stairs and showing off its shape (the latter being at present in bad order and geting worse). But a very small part of this immense power is put to work to benefit man, while under proper management, fully two-thirds of it could be made available and the falls still left a thing of beauty and a joy forever. The works now using the water seem to have their outfalls on a very high level. Were these at a lower level, far less water would do the same work. Then look at the way the falls itself is wasting good material; there is that ugly V-shaped crotch in the "horse-shoe," where the water is now about twenty feet deep. Some aesthetic asses become very emotional over this fault, referring to it as the "great green heart." It reminds me more of a stomach, greedy and insatiable and bidding fair to soon ruin the whole show by eating back into the rock and forming a narrow sluice. To this feature, more than the power houses, can be attributed the shallowness of water on the other parts. My remedy is this: let the State of New York and the Province of Ontario jointly build large sluice-ways around the falls, their combined capacity great enough to accommodate all the water running over the falls. By diverting the water to them, the edge of the falls can be built up of concrete and trimmed off to a uniform level, so that one-third of the water would at all times keep the falls falling. If thought necessary the coping could be made of vanadium steel, so as to insure against any wearing away of the bed and spoiling it. This would allow of an immense amount of energy to be available which would give employment to many people and furnish necessaries of life to thousands at cheaper prices than if made by using coal and that without smutting up the country with smoke. In addition it would bring a good revenue to the State from the renting of water supply, and it wouldn't be any more difficult than for the Panama Canal engineers to take care of the Chagres River, or the Dutch engineers to keep out the Atlantic Ocean, or for the Dublin police to keep the loyal Irish from setting Ireland free. A strong, husky man looks far better when engaged in honest toil, making the world better for his existence, than when he is standing around a street corner showing off his shape, and I say the same of a waterfall.

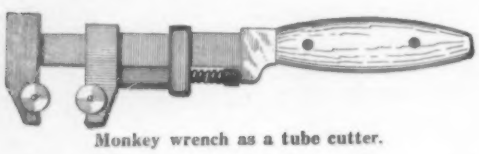
Washington, D. C. SENEX SMITH.

Suggestions for the Workshop

A Simple Tube Cutter

By William Grötzinger

THE monkey-wrench may be made to serve as a tube cutter by the following simple method: Steel disks such as are used on the regular tube cutters are put on the jaws of the wrench. These disks can be



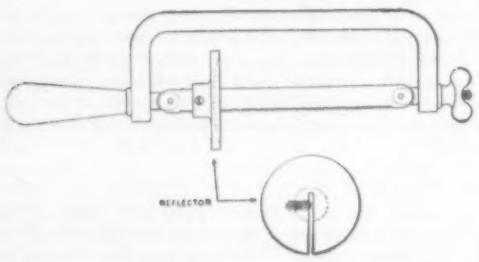
Monkey wrench as a tube cutter.

had for a few cents from any hardware store. Bore a small hole through each jaw of the wrench. A stove bolt is passed through each disk and tightened to the jaws of the wrench. Allow a little room for the disks to turn. To cut different sizes of pipe, simply adjust the jaws, as you would to fit the wrench on a nut.

Using a Reflector on a Hacksaw

By H. B. Chapman

WHEN sawing sheet metal with a hacksaw and trying to saw to a line which has been scribed on the metal, the task is found very difficult unless the light is just right. Recently a man in the shop where the writer is employed made a reflector for his saw so that it would throw a good light on the



A reflector on a hacksaw.

work. A round disk of brass was made as shown at *A*. The disk was turned so as to have a collar at the back; a slot was cut through the center of disk so that it could be slipped over the saw. A 3/16-inch set screw in the collar served to hold the disk in place while in use. Some white enamel was spread over the face of disk to provide a good reflecting surface.

Handy Man's Medicine Chest

By W. R. Ingraham, M.D.

Remedy for Slight Burns.

DOES the "Handy Man" ever burn himself? Of course. One of the best, most convenient remedies he can use is a solution of picric acid in water. It is very satisfying and just a little gratifying to have the excessive pain of first degree burns instantly quieted. First degree burns are superficial, and the nerve endings, not being destroyed as in the deeper second and third degree burns, set up a howling remonstrance in the way of pain.

Picric acid of a strength 1 to 200 (about one-third teaspoonful to one pint of water) or a saturated solution is used. It is antiseptic and will prevent suppuration. It is analgesic and "will make it feel good." It stains yellow, but the stain comes out in the wash. Keep a small vial of the acid handy. When you get a burn (if skin is not broken), sprinkle a little acid in a basin of water. Saturate a strip of gauze or cloth with this and bandage in place. In a very little while (or as soon as the picric acid coagulates the albuminous exudate) the pain is quieted.

For Deep Burns.

Use picric acid as above for deeper burns (blisters and broken skin), but be more careful. Pour a little alcohol in the basin to be used. Roll it about so that the alcohol wets all the inside. Set it on fire and every germ in that pan dies instanter. Pour water that has been boiled from the tea kettle into the pan, and add the picric acid. Bandage the burn with clean aseptic gauze and saturate it with the solution. Blisters should be opened and contents expressed. Open them with a needle, the business end of which is sterilized by holding in the flame of a match. The soot will do no harm. For still deeper burns or burns of large area (third degree) much can be done by the above to alleviate suffering until physician can be had, but send for him at once. The attending shock is serious.

For Small Cuts and Abrasions.

If the Handy Man cuts his finger or knocks the skin off his knuckle he should proceed as follows: I. Cleanse the wound. Hydrogen peroxide is becoming a favorite antiseptic and with good reason. Besides being a germ killer it acts and cleanses mechanically. Its effervescence dislodges and carries away dirt and any foreign matter that might infect the wound. Try it on a splinter of decayed wood at which you have picked and fussed in an endeavor to extract. The hydrogen peroxide "boils" it right out. Therefore cleanse the cut by pouring on from a bottle a little of it, full strength. (A medicine dropper is convenient.) II. Dust on a little aristol. Aristol is an iodine compound, having the useful antiseptic properties of iodoform, but lacks the disagreeable odor and irritating properties of the latter. With the exudate from the wound it forms a good artificial antiseptic scab. It may be purchased in small sifting top bottles. III. Apply a protective dressing. A bit of absorbent cotton pasted down over the wound with collodion forms a stiff protecting shield, which stays in place. May be washed over with soap and water and will not require renewal for two or three days. For a contused finger nail, or cut near end of finger so liable to painful knocks it forms a stiff, comfortable thimble that is soft inside, looks better than a rag and does not interfere with work.

For smaller, more superficial wounds than the above a useful dressing, better than the questionable court plaster, or even adhesive tape, is collodion, to which has been added aristol or iodoform (50 grams to the ounce). A small glass rod, the ends of which have been smoother by melting with a blowpipe in an alcohol flame, makes a convenient applicator for the collodion. Pass it through the cork and leave it in the bottle permanently.

For Wounds and Painful Injuries.

In case of deep wounds the collodion dressing is not applicable and the soothing properties of a moist dressing are desired. Pour a measured quart of water into the basin to be used. Gage the quantity with your eye. Throw out the water and sterilize the basin (as above) by pouring a little alcohol into the basin and rolling it about to wet all the inside. Set it on fire with a match and the basin is thoroughly sterilized. Pour a quart of water that has been boiled directly from the teakettle into the basin. One tablet bichloride of mercury (as usually prepared) makes a 1 to 2,000 solution when added to the quart of water.

Sterilize another smaller basin by the method described above and pour a part of the solution into it for later use. Cleanse the wound as thoroughly as conditions permit. Hydrogen peroxide of full strength or diluted with water is usually sufficient. If the wound is very dirty and much lacerated, as machinists' wounds are apt to be, the following method of cleaning is perhaps better:

Add to 1 quart warm water in which the wound is to be washed 2 teaspoonfuls lysol. (This makes about 1 per cent solution.) Lysol has an odor similar to carbolic acid, but is not so poisonous. It forms a soapy solution, hence its value as a cleansing agent. It numbs the parts and makes them less sensitive to pain. The part should now be thoroughly irrigated with the bichloride solution in the larger basin, being sure that all the lysol solution is removed from the wound.

Surgically clean gauze (sterilized, aseptic) is now bandaged over the wound and moistened with the clean bichloride solution saved in the smaller basin for this purpose. Bandage lightly. If the gauze dries and the wound becomes painful inside of 4 hours, remove the outer plain bandage and moisten the gauze with the solution again. Use weaker bichloride of mercury solution for the next and succeeding dressings (1 to 4,000). If too strong healing granulations may be retarded.

Home Made Aseptic Gauze.

Plain aseptic gauze (absorbent) may be prepared at home by the following method: For each five yards of ordinary cheese cloth use one-quarter pound common washing soda to sufficient water to cover the gauze. Boil for one-half hour and rinse in several changes of water to remove the soda. This process removes the fat or oil from the fabric and makes it absorbent. After it has been dried it is cut into suitable sizes—strips one yard long and four inches wide are convenient. The gauze is now sterilized and packed ready for use in the following manner: Screw top jars with caps are placed in a large bread pan, and the gauze is arranged loosely in the other end of the pan. Place in the oven and bake until the gauze begins to scorch slightly. Remove pan and all to a table and while hot pack the strips into the jars. Use a pair of forceps or long tweezers and a short wire for this purpose. The tips of the tweezers and wire should be made sterile by passing through an alcohol flame several times, or they may be sterilized by baking with the jars and gauze.

Seal the jars and you have a good supply of aseptic gauze ready for instant use.

When using the gauze it is well to remove the strips with a pair of tweezers, the tips of which have been sterilized in an alcohol flame. This avoids possibility of contaminating the gauze left in the jar. A quick, convenient alcohol flame may be had by saturating a small pledget of cotton in the mouth of a bottle.

Moist bichloride gauze, which is expensive to buy, yet invaluable in case of accident, is made as follows: Prepare and pack the gauze as above. Then prepare a 1 to 1,000 solution of bichloride as just explained (burning out the pan with alcohol and using boiled water). Pour this solution over the gauze in the jar until it is thoroughly saturated and allow it to stand for 24 hours. Pour off the excess and seal it air-tight. If dry bichloride gauze is desired prepare the gauze as above, dry it thoroughly in the oven and repack. However, the moist gauze is to be preferred.

In using this gauze observe the precaution stated above, i. e., use weaker antiseptics after 24 hours and for subsequent dressings.

Moist picric acid gauze for burns may be made and kept in a jar for immediate use as follows: Prepare and pack aseptic gauze, as above. Prepare a picric acid solution in the manner described (1 to 200) and pour it over the gauze. Let it stand and then pour off the excess and seal it air-tight.

How to Extract Broken Watch Screws

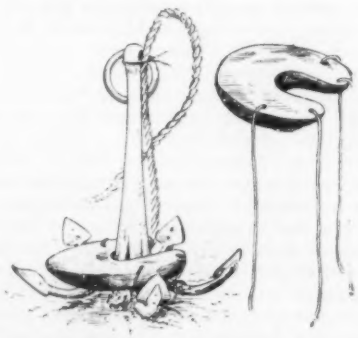
Device for removing broken screws.

SMALL screws frequently break off in clockworks, and in small machinery, and can not easily be removed. A simple tool to extract the broken off screws is here shown. It consists of a cramp, large enough to reach across a watch plate. Provide two or three sets of 3/32-inch steel screws, with different sized hardened chisel-like points. To use the tool, tighten the chisel point against the broken screw, and when you have a firm grip, turn the whole tool around, and the broken screw will invariably be drawn out.

The Grapnel as a Mushroom Anchor

By Albert F. Bishop

AN ordinary grapnel can be made to give good service as an anchor by attaching to it a lead weight of U-shape, flat on the top and rounded on the bottom to fit the grapnel. This weight may be simply tied on the grapnel with cords when desired. It is not supposed to be used around a rocky or stony bottom. On a sand or soft bottom it acts like a mushroom anchor. Where a small launch or boat is at anchor with a bridle it generally lies across the current or broadside to the wind. This is quite important for some kinds of fishing, and it is always necessary to use heavier anchors or grapnels when in this position. The lead weight is



Weighted Grapnel as a mushroom anchor.

easily cast in sand by taking a bent piece of tin and scooping out the sand to the shape desired. It is not necessary to make a pattern. The weight should be roughly about fifteen pounds for a ten-pound grapnel. The rope is spliced in a ring at the bottom of the grapnel, brought up to the top and seized with a small cord to the ring or eye. Two turns of ordinary cord are generally enough for the seizing, which is called the trip cord.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

The Production of Anthracite Coal in 1910

THE United States Geological Survey has issued an advance chapter from "Mineral Resources of the United States" for 1910, in which Mr. Edward W. Parker gives the following interesting statistics:

With the exception of the "boom" year, 1907, the production of anthracite in Pennsylvania in 1910 was the largest in the history of the industry. The quantity produced in 1910 was 75,433,246 long tons, an increase over 1909 of 3,048,997 long tons, or 4 per cent. The value increased from $149,181,587 in 1909 to $160,275,302, a gain of $11,093,713, or 7.4 per cent. The production in 1910 was within almost exactly 1,000,000 long tons of the maximum record for 1907, when the output amounted to 76,432,421 long tons. The value of the product in 1907 exceeded that of 1910 by $3,308,754. The average price per ton at the mines in 1910 was $2.12, against $2.06 in 1909, $2.13 in 1908, and $2.14 in 1907.

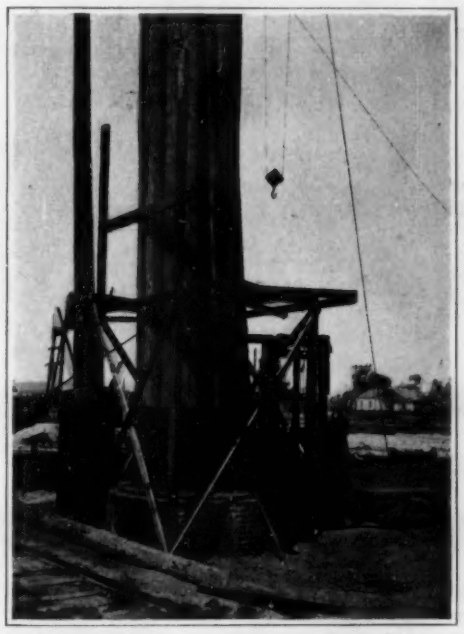
Of the total production in 1910, 65,735,024 long tons, or 87.1 per cent, were loaded at the mines for shipment to distant points; 1,804,082 tons, or 2.4 per cent, were sold to local trade and employees, and 7,894,140 tons, or 10.5 per cent, were consumed in the operation of the mines. In former years the colliery consumption was not considered as having any market value, consisting as it did of screenings, or culm, which unless so used was wasted. More recently through the invention of grates and furnaces adapted to the use of small sizes of anthracite, stimulated by the higher prices of the prepared sizes, the percentage of waste has been reduced to a minimum. "Buckwheat," "rice," "barley," and even culm are now important steam-raising fuels, particularly in hotels, apartment houses, and large office buildings in the larger cities of the East, where smoke-inhibiting ordinances are in force. In fact, these small sizes are now the only grades of anthracite used to any extent for this purpose, and are the only sizes that will compete with bituminous coal for steam raising in the eastern markets. An object lesson in practical conservation is here furnished and, to the credit of the operators in the anthracite region be it said, it was put into effect a number of years before the agitation over the conservation of natural resources began. Not only are the small sizes produced in the present mining operations sold and utilized, but the unsightly culm banks which blotted the landscape in the anthracite region are fast disappearing as the usable coal is being recovered from them by washeries. The prices for buckwheat at New York Harbor in 1910 ranged from $2.20 to $2.50 per long ton; rice ranged from $1.65 to $2; and barley from $1.35 to $1.50. With 65 per cent of the tidewater price representing the value at the mines, the prices for these sizes f. o. b. cars at mines were: Buckwheat, $1.43 to $1.63; rice, $1.07 to $1.30; and barley, 88 cents to 98 cents. The culm used at the mines is valued at 25 to 50 cents a ton.

Of the total production of 75,433,246 long tons in 1910, 4,184,629 tons were recovered from the old culm banks by washeries, and 91,833 tons were recovered by dredges from the bed of the Susquehanna River. The total output from the mines was 71,156,784 long tons. In 1909 the mine production was 67,945,137 long tons.

Preserving Poles

FOREST SERVICE BULLETIN 84, entitled "Preservative Treatment of Poles," contains a large amount of well-arranged information which should prove interesting, not only to many general readers, but especially to the users of telephone and telegraph poles. In this publication are summed up all the excellent results achieved by a number of experts of the Forest Service in their effort to treat poles with certain preservatives in order to increase their durability. In 55 pages of text are given the results of the co-operative experiments aiming to simplify commercial pole-treating practice by the use of the latest approved methods. The scheme of the *Bulletin* may be outlined briefly as follows: General principles of wood preservatives; results of seasoning tests; brush method of treating poles; open tank process of treating poles; results of treatment by species; design and operation of pole-treating plants; increased life afforded by preservative treatment; and financial saving. The last two chapters are of high practical interest and value to large pole using concerns whose experience warrants them in employing means for impregnating the portion of their poles most subject to decay—the butt. It is brought out that the cost of the treatment varies greatly according to the methods employed and the quantity of preservatives used, but the results are correspondingly very much better for the more thorough treatments.

Mr. O. T. Swan whose results of more recent experiments are included in this bulletin, devised the first really practical open tank method of treating the butt ends of poles. He greatly advanced the efficiency and compiled very important data which he uses to show that a great saving is possible and that plants for butt treatments may be constructed in a simple and inexpensive manner. Mr. Swan built his own design for steeping the poles and this has proved so successful that an illustration of the tank now in use is given here. The poles are treated by dipping them in a tank containing the preservative fluid, by standing them in an open tank and securing an absorption of the preservative by periods of heating and cooling. Photograph of a cross section near the lower end of the poles is also given to show the penetration of the creosote oil.



Experimental open tank treating plant showing successful type of pole holding frame work.

Western yellow pine cut off at the ground line showing penetration at this point by the open tank method.

Mr. Swan is well known in the world of scientific and practical wood preservation, and the results he achieved are sure to meet a cordial welcome among creosoting concerns. His figures show painstaking thoroughness and accuracy which gives them technical and economic value.

Spruce Yarn

THE expression "mahogany overcoat" used to be employed as a sort of synonym or euphemism for "coffin"; but if things keep on as they have started under the impulse of inventive genius, we may soon hear of "locust shirts" and "bass-wood collars" and even "long-leaf pine ulsters." The Germans have long since endeavored to make themselves independent of foreign sources for the various raw materials which they require for their own home consumption as well as to manufacture for export, and now we hear that there has been made of spruce wood a yarn that is quite spinnable. Whether this is a "yarn" or not, cannot be said, but on the authority of *Der Holzkäufer*, which is many times removed from being a comic paper, and in fact revels in the most wooden of statistics for the foresters and lumber dealers of Germany the formidably named "Aktiengesellschaft für Garnfabrikation" of Berlin has for some time been having experiments made on the same lines as those which have resulted in the production of artificial silk and cotton; and the result seems to be gratifying, as spruce is comparatively plenty in the "Fatherland," while as yet (there being no Luther Burbank on her rolls) cotton and silk are not numbered among the productions of central Europe. The new product is said to have a fine finish and much better surface than is usual with the natural fibers as yet used for spinning. The Technische Laboratorium für Materialprüfungen of the Technical School for Textile Industries in Reutlingen has shown that when leather feed-rolls are used, the new yarn when used as warp or chains is 12½ times as strong as jute; and when used as woof or fillings, 30 times as strong. As against jute, "sylvalin" has the very great advantage of being odorless, even when moist. Articles woven therefrom are naturally not exposed to the attacks of moths. If all these things are true, and the process is not too expensive, there must be a good future for the new yarn, especially if (as is said) it can be worked with all the usual other fibers. The first attempts at weaving have been with wall tapestry, which are most satisfactory in pattern and color, and have the great advantage of being so smooth that dust does not attach itself thereto as readily as to other stuffs used for the same purpose; also that in brushing them down they do not get rough. So-called Japanese mats have been made of sylvalin, and are hardly to be distinguished from those made of rushes. There is this great advantage on the side of the sylvalin yarn, that it may be woven in the loom; whereas by reason of the shortness of the individual pieces, rushes can be worked up only by hand. The new material has also been made up into cord of various kinds, alone and in combination with other materials, for decorative and other purposes.

One Hundred and Seventy-one Dead Horses a Day

WHILE the hot period of July in New York was more severe than usual, the deaths of work horses due to the heat during those six days is a very strong argument in favor of the electric commercial wagon.

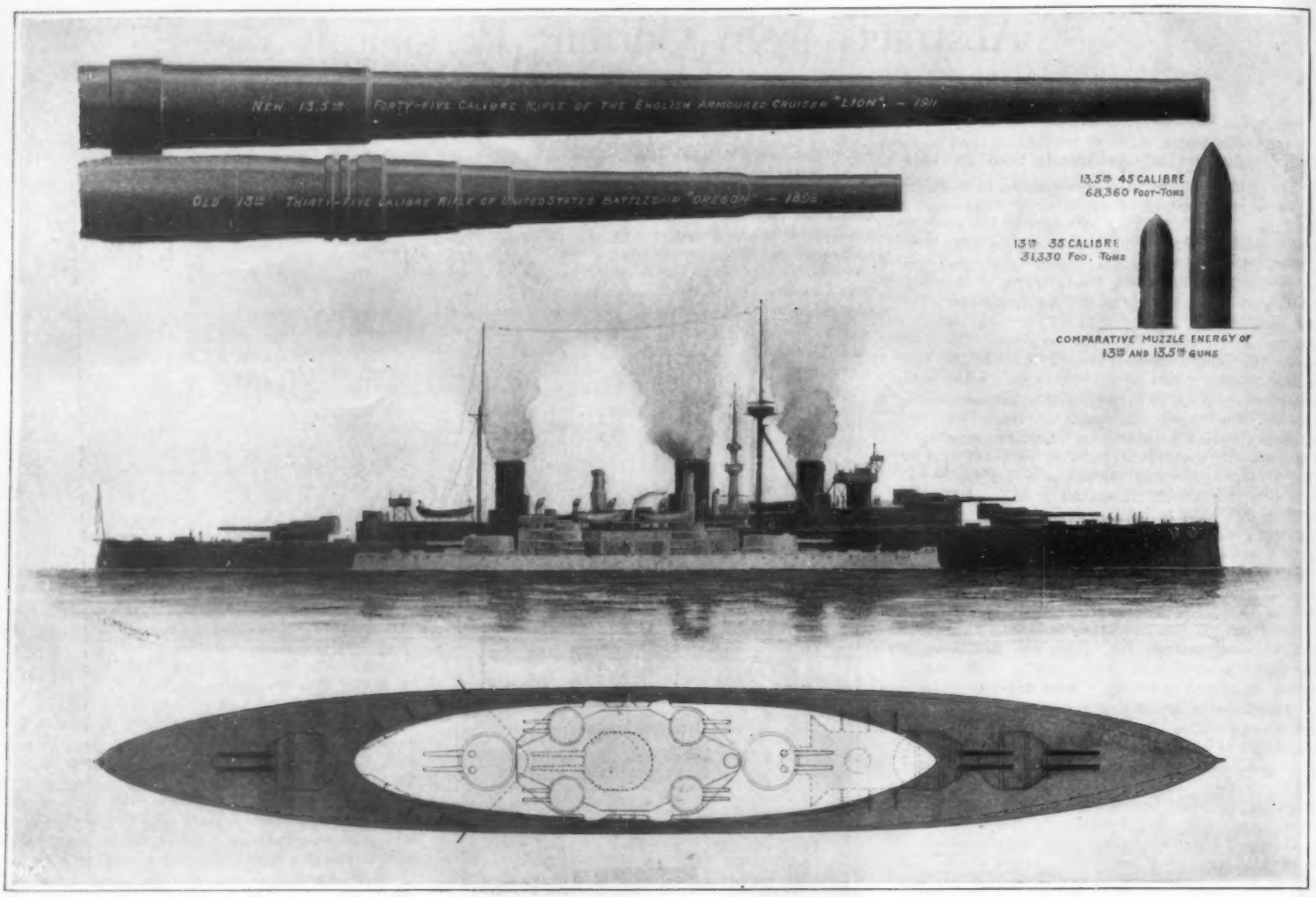
The health department of New York city, which has the task of removing dead horses, reported that during the six working days of the hot period 171 horses died each day—a total of 1,026.

These horses represented over half a million dollars cash value, which was entirely wiped out in a single week.

In addition to this the horses not affected fatally were able to work at scarcely half their normal capacity, and fully 25 per cent of the drivers' time was consumed in staving off sun-stroke by frequent applications of water and frequent rests in the shade.

It is estimated that the money represented by the horses which died would pay for a sufficient number of electric vehicles to do all of the work done by the horses, and do it more efficiently and economically.

In New York city, where it is estimated that there are in the neighborhood of fifty thousand draft horses, not less than four per cent die annually from the effect of heat in summer and slippery pavements in winter. This million-dollar annual loss is in addition to the normal deaths, and represents a tremendous increase in the cost of horse-haulage.


NEW 13.5" FORTY-FIVE CALIBRE RIFLE OF THE ENGLISH ARMOURED CRUISER "LION", — 1911
OLD 13" THIRTY-FIVE CALIBRE RIFLE OF UNITED STATES BATTLESHIP "OREGON" — 1895
13.5" 45 CALIBRE
68,360 FOOT-TONS
13" 35 CALIBRE
31,330 FOOT-TONS
COMPARATIVE MUZZLE ENERGY OF 13" AND 13.5" GUNS

The 700-foot dreadnought "Lion" of 1912 is here compared on the same scale with the "Oregon" of half her length, built nearly twenty years earlier. Note the high freeboard, and the lofty elevation at which the guns are now carried.

TWENTY YEARS' GROWTH OF THE ARMORED SHIP

The New British Dreadnoughts

How the New 13.5-inch Gun is Mounted on the American Center-line Plan

THE accompanying illustrations represent the same ships of the new British warships of the "Orion" and "Lion" types which will commence their trials in the fall. The main points of interest in these vessels are that they are the first British ships of the dreadnought class to carry all their guns on the center-line (which are of the new 13.5-inch model) and that the battleship-cruiser "Lion" is of a greater tonnage than her contemporary battleship, the "Orion."

A deck plan view of the "Orion" class was given in our issue of the 27th of May together with an article on the center-line disposition of guns. The points need not be recapitulated here, excepting that the further reasons given in England for the new arrangement of the main battery are (1) that the greater tonnage of the 13.5-inch prohibited so large a weight being placed on the beam (as the 12-inch were in previous British battleships) and (2) that of the *en echelon*, or diagonal placing of the guns was unsatisfactory. Theoretically the *en echelon* disposition should have enabled all the guns to bear on either broadside, but in practice it was found that the designed arcs of fire had to be cut down to prevent one barbette firing into or damaging the other by blast.

The "Orion" carries 10-13.5-inch 45 caliber guns on a displacement of 22,680 tons, together with an "anti-torpedo" battery of 20-4-inch quick-firers. The 13.5-inch weapons are disposed in a similar manner to the 14-inch of the "New York," i. e., the second pair forward fire over the first, and the fourth over the fifth aft. The third pair is placed on the same level as the fifth, but the British ship cannot fire her fourth pair ever so wide an arc or so far forward as the "New York" on account of the superstructure between the third and fourth positions, which does not exist in our ship. The 13.5-inch in the "Orion" (and also in the "Lion") are of a very powerful type, weighing 87 tons and firing a projectile of 1,250 pounds with a muzzle velocity of 2,821 foot-seconds, developing an energy of about 69,000 foot-tons. The penetration is 25½ inches of Krupp N. C. armor at 3,000 yards; the rate of fire is the same as that of the 12-inch, viz: 2 rounds in 90 seconds.

The "anti-torpedo" armament consists of 20-4-inch quick-firing guns as in previous dreadnought ships. The British admiralty apparently seem satisfied with this type of gun in spite of the employment of larger guns for this purpose abroad. They consider that the higher command of the smaller guns puts them on an equality with 5-inch or 6-inch weapons carried in a main battery. These guns, when not in use, disappear into armored shelters; a lesson evidently from the impotence of the Russian ships after the battle of Tsushima to destroy the attacking Japanese torpedo boats, owing to the wrecking of the exposed light quick-firing guns by the abnormally high-explosive shells used by the Japanese. These guns are no longer mounted on the barbette tops, but are distributed at two levels in the superstructures, and are so arranged as to bring a good proportion to bear ahead and astern, as it is from these points torpedo attack is mostly to be feared. Four submerged torpedo tubes are fitted, the torpedo rooms being inclosed in thick armor. The provision for boat stowage is of a novel type, the boats being placed between the tripod mast and the aft funnel and protected by the low blast screen seen in the illustration which conceals them. This is a remedy for the damage incurred by the boats in previous gun trials of British dreadnoughts by the concussion from the discharge of the big guns.

The dimensions of the "Orion" are: 545 feet (length) by 88½ feet (beam) by 27½ feet (draught), and with 27,000 horse-power and Parsons turbines the estimated speed is 21-22 knots; the coal supply is normally 900 tons but capacity is provided for a maximum of 2,700 tons together with 1,000 tons of oil fuel. Four propellers and double rudders are used. The protection to the water line is 12 inches amidships, thinning to 2¾ inches forward and aft; over this there is a belt of armor (extending to the extreme bulkheads) of 12 inches. The gun positions are understood to be 11 inches thick, the hoods being 12.8 inches thick, while stability is insured by a protected deck of 2¾ inches under which are four unpierced bulkheads dividing the ship into five watertight compartments. The special internal protection against torpedo attack is of a secret nature.

The "Lion," which represents the latest development of the battleship-cruiser, is of 25,250 tons and has the enormous propulsive power of 70,000 horse-power; her designed speed is 28 knots; it is, however, confidently expected that she will attain 30 knots on her trials. For this speed a hull of fine form and great length (to accommodate the boilers and engines) is essential. The dimensions are: 700 feet (length between perpendiculars), 86½ feet (beam), 27½ feet (draught). The three enormous funnels are surrounded by steel screens to protect them from the blast of the guns; these also give protection to the boats as in the "Orion"; further accommodation for boats is made on the superstructure aft of the "wireless" pole-mast. Except for this and the low erection round the conning tower, the hull is devoid of the usual excrescences so liable to wreckage by high explosive shells. The guns are of the 13.5-inch pattern, eight being mounted, but in a different manner from the eight of the "Michigan." The second pair forward fire over the first, the third and center barbette is placed between the second and third funnels and the fourth by itself aft; all the guns fire on the broadside, four ahead and two astern. The new system of fire-control is installed in this ship (and also in the "Orion") whereby the guns can be trained in unison or independently by supplementary electric motors controlled from the range-finding position on the tripod mast. A reserve armored control-station is placed between decks; also, fire-controls are fitted to the 4-inch quick-firing guns. The searchlights are mounted on the bridge forward and on top of the blast screens.

The motive power is supplied by 42 Babcock & Wilcox boilers and Parsons turbines, the maximum fuel

(Continued on page 236.)

The Creation of "Artificial Life"

The Making of Living Matter from Non-living

By Benjamin C. Gruenberg

FROM time to time we are informed that the Riddle of the Universe has been solved by the artificial production of "life" from non-living materials. But each time we wondered how it was done, for a few days, and then find out that it wasn't done at all. The riddle is still there. The expression "artificial life" has been used in recent years for two entirely different sets of ideas.

On the one hand is the attempt to make artificial combinations of matter behave like living protoplasm —that is, to make live matter out of the non-living materials lying all about us. On the other hand is the attempt to make the eggs of various animals develop without the co-operation of the sperm—or to produce "artificial parthenogenesis," as it has been called. Both kinds of experiments are calculated to throw much light on the fundamental nature of "life;" but they differ considerably in their methods as well as in the point of view that prompts them. We shall discuss first what has been done toward the making of "artificial life" in the cruder sense.

The problem of artificial life is connected intimately with that of the *origin* of life, and also with that of the *characteristics* or distinctive properties of living matter.

From earliest times there has persisted the idea that plants or animals may arise "spontaneously" from non-living matter, notwithstanding the common experience of mankind that wherever the origin of a living thing could actually be observed, it was seen to arise from another living thing. This widespread belief in "spontaneous generation" no doubt owed its tenacity to the fact that in many cases the continuity between generations could not be directly observed. For example: Eggs of eels had never been seen until within our own times; maggots were known to develop in putrifying meat, but no one had seen the flies deposit their eggs in the meat; the presence of tape-worms and other parasites within the bodies of human beings and other animals; the presence of insects within the "galls" of plants, without any apparent means of entrance—all these facts served to perpetuate the idea that life can, and regularly does, arise spontaneously. The idea that all organisms arise from pre-existing organisms is a comparatively modern one; and it was accepted on philosophical grounds long before there was any actual demonstration of the principle. From the nature of the case, however, the principle, *omne vivum e vivo* cannot be proven, since it involves a negative. It is equivalent to the statement that living matter does *not* arise from non-living matter. In the seventeenth century Francisco Redi, a physician of Florence, showed that by preventing the access of insects to meat, no grubs or maggots could be formed in it, no matter how much it putrefied. In opposition to these experiments, a Scotch clergyman named Needham attempted in the middle of the following century to show by means of experiments that "wheat-eels" and other animals do arise spontaneously. He showed incidentally that tiny animalcules appeared in extracts of vegetable matter, on long standing, even after these had been boiled. But his contemporary, the Italian monk Spallanzani, showed that if the decoctions were thoroughly boiled and closed against the entrance of dust, there would be no appearance of life. Although Spallanzani's experiments were not beyond criticism, his conclusions were in harmony with those accepted by practically all biologists to-day—namely, that all existing plants and animals have originated from others of essentially the same kind.

But although the notion of "spontaneous generation" has been thus abandoned by all scientific thinkers in modern times, the question of the origin of life took on a new interest with the spread of evolutionary thought during the latter part of the nineteenth century. Darwin did not attempt to answer this question. He took for granted the origin of life, in some simple form, as the beginning of that evolution to higher forms which he attempted to explain with his theory of natural selection.

Fig. 1.—An "artificial plant" which was produced in a test-tube

Fig. 1a. Artificial organs showing mushroom shape.

Apart from the theory of special creation for each species, there is only one opinion possible as to the origin of life, and that is that at some time in the past non-living material passed into a living condition—in other words, that life did originate "spontaneously!" This notion of spontaneous origin of life must not be confused with the older notion of the spontaneous generation of plants and animals of all degrees of complexity.

Alfred Russell Wallace and others think it necessary to assume that the origin of life from non-living matter was brought about by the interposition of some spiritual or divine influence, of the nature of which we know nothing. Charlton Bastian and another school of biologists think that the transition of non-living matter into the living state has taken place continually from the first, and is taking place now. But most biologists accept the view that living matter originated from non-living in the very remote past, and that all living things now existing are derived by a succession of generations from the primitive origins.

The Swedish physicist Arrhenius and the Englishman Lord Kelvin are strong advocates of the view that life upon this earth was developed from primitive "germs" that were brought here in the remote past "upon the wings of light" or upon some meteorites, through lifeless space. It has been pointed out a number of times that this account of the origin of life simply shifts to some other planet or system the theater of the origin, without giving us any suggestion as to the manner of the origin.

The requirements of any evolution theory are met by the assumption that life originated "spontaneously" from non-living matter at some time in the history of this planet, or of the universe. But to know whether such an assumption is warranted, we should know more about the characteristics of living matter, especially in its relation to non-living matter. Until comparatively recent times the processes going on in living plants and animals had been so little studied that the idea of life being dependent upon external conditions was entertained by very few men. With the development of modern physics and chemistry, and with the application of the methods as well as of the results of these sciences to the study of living things, this idea rapidly spread, until it is now pretty generally accepted. Moreover, the strong tendency during the past two generations to unify all knowledge, and to extend the principles of one science to the problems of all others, have stimulated the search for the physical and chemical foundations for "vital" processes.

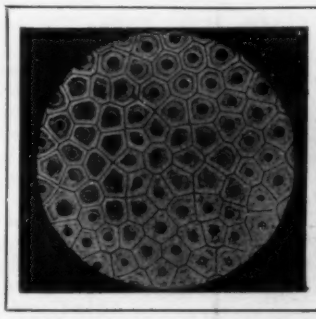


Fig. 2.—"Artificial cells" formed by the diffusion of drops of ten per cent potassium ferro-cyanide in a ten per cent gelatine solution.

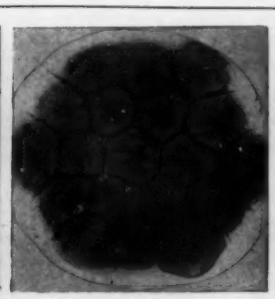


Fig. 3.—"Artificial cells" produced by the diffusion of colored drops of salt solution in a less concentrated solution.

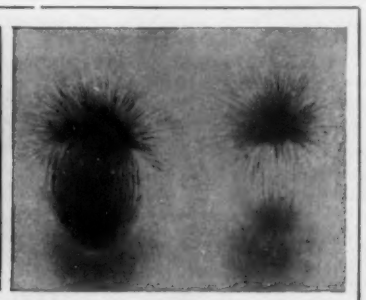


Fig. 4.—An imitation of the appearance of nuclear division produced by diffusion between two poles of the same sign.

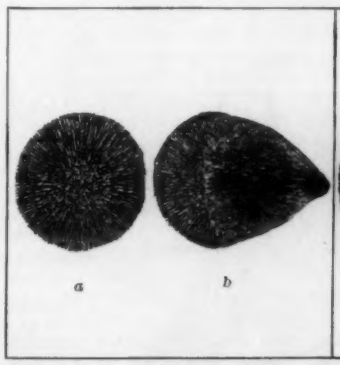


Fig. 5.—Fields of force produced by diffusion. (*a*).—Monopolar, produced by a drop of blood in salt solution of higher concentration. (*b*).—Bipolar produced by a drop of blood and a grain of salt.

Fig. 6.—A bipolar field of force produced, according to the methods of Prof. Stéphane Leduc, by diffusion between two drops of blood in a salt solution of higher concentration.

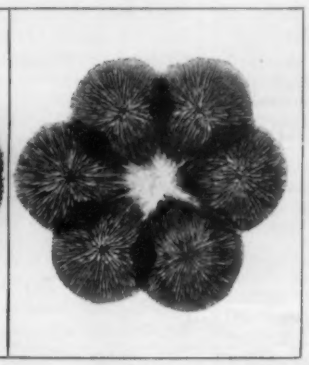


Fig. 7.—Diffusion figures produced, according to the method of Prof. Stéphane Leduc, by drops of India ink in a solution of potassium nitrate.

EXAMPLES OF SO-CALLED "ARTIFICIAL LIFE"

The word "protoplasm" had a varied career for about twenty years; but about fifty years ago it began to be definitely applied to "the physical basis of life," or the substance found in the cells of all plants and all animals. We know a great deal about this peculiar substance—or rather combination of substances; but there is still a great deal more that we do not know. There have been many opinions as to the structure of this living matter—that it is fibrilla, that it is like a net-work, that it is a mass

(Continued on page 236.)

The Inventor's Department

Simple Patent Law: Patent Office News: Inventions New and Interesting

The Cuntz Ocean Telephone Electric Cable

SINCE the first message was sent under the Atlantic, there has been but little change in the cable itself. The copper conductor has been enlarged and there have been improvements in manufacture, but in its essential features the latest trans-Atlantic cable is only an enlarged copy of the one by which the farsightedness and energy of Cyrus Field first joined Europe and America.

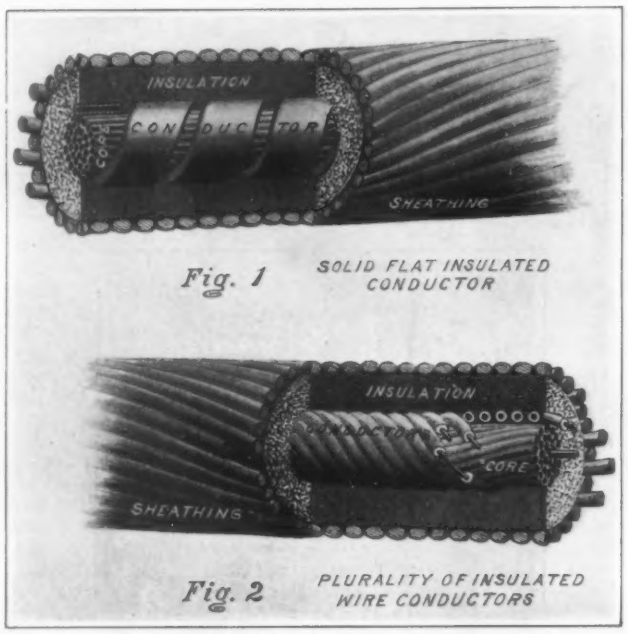
The sending and receiving apparatus at the shore ends of the cable has been improved more rapidly. By means of an artificial cable, having the same electrical properties as the real one, duplex working, or the sending of messages in both directions at the same time, has been made possible, and the transmitting and receiving instruments have been made more accurate and sensitive. As the result of these changes there has been a gradual increase in the speed of transmission until now, under favorable circumstances, about forty or fifty words a minute can be sent in each direction.

But the limit of improvement appears to be reached unless the cable itself is radically changed. The cause of the slowness of submarine telegraphy as compared with that on overhead land lines is what the electricians call the "electrostatic capacity." On account of this, when an electric current is sent into the cable it must charge the whole length of the cable before its effect will be felt at the far end. A great deal of the current is used in charging the cable, and if the "makes" and "breaks" of the sending key follow too quickly upon each other, or if the direction of the current is changed too rapidly, the flow will be retarded and choked, so that no signals at all will reach the receiving end.

A rough analogy will make this action clearer. Imagine a long rubber tube with very flexible walls, through which water is to be pumped. When the water is pumped in, before any of it reaches the far end, a great deal of it will be used in distending the tube, and it will take some time for any of it to reach the distant extremity. Even when the tube is full, and the attempt is made to work the pump at the transmitting end back and forth, the water pumped into the tube and drawn out of it will be used largely, if not entirely, in increasing and diminishing the pressure on the walls of the tube, and if the pump is worked fast enough, no effect whatever will be felt at the receiving end.

In order to get rapid action we must stiffen up the tube. If this is done, and its walls are made absolutely unyielding, any change in pressure applied to the water at one end will be almost instantaneously felt at the other end.

Now, returning to our ocean cable, if we can find some means of "stiffening" it electrically, we can counteract the effect of the electrostatic capacity and enable the current to flow without retardation, and the signals to be sent clearly and quickly. A contribution toward the solution of this problem comes to us in the invention of J. H. Cuntz of Hoboken, N. J., which has recently been made public. The electrical analogy of the stiffening we put into the rubber tube is called "inductance," or "self-induction." Inductance has effects opposite to electrostatic capacity, and when properly placed and proportioned can counteract it to any degree desired. As the capacity is distributed throughout the length of the cable, the best disposition of the inductance is to distribute it also throughout the cable. The problem has been to do this in a practical, commercial way, but it may now be regarded as solved. The



A new design of submarine cable with distributed inductance to counteract capacity and render possible rapid transmission.

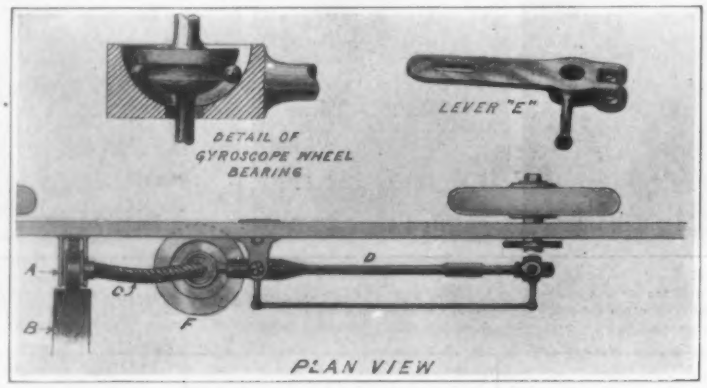
chief sources of inductance are coils of wires, and if these coils have iron cores, their inductance is greatly increased. What has now been done is to wind the copper conductor of the cable in a long open coil about a thin central core, and thus make the entire cable a source of inductance, so overcoming the effects of the capacity and at one stroke increasing the speed of signaling ten, twenty or even fifty-fold.

What has been said about telegraphy applies with even greater force to telephony. Here the minute currents caused by the vibrating diaphragm of the transmitter vary at the rate of hundreds and even thousands of alternations a second, and in an ordinary ocean cable they would be choked up and obliterated after going a few miles. In underground cables the effects of capacity are also very troublesome, and telephony has been greatly hampered on this account. But a method was devised a few years ago (by Prof. Pupin of Columbia University) which has been very helpful in underground telephony, as well as on long overhead lines. By this plan inductance coils are placed at intervals along the cable so as to approximate the effects of uniformly distributed inductance.

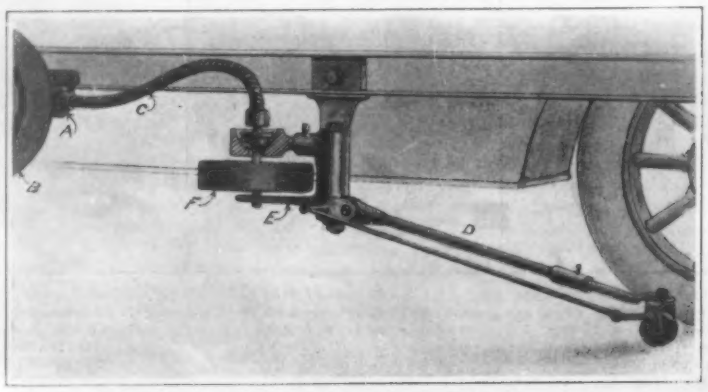
For long-distance submarine work, however, such coils would be impractical. They make humps and introduce mechanical weaknesses which would cause difficulty and danger in laying a deep sea cable, and would increase the cost of maintenance and repair probably to a prohibitive degree.

The new cable, which has just been patented by Mr. Cuntz, avoids these difficulties and is conspicuous for its strong and compact mechanical design, in addition to its efficient electrical properties. As its process of manufacture becomes systematized, it will be made at a cost little, if any, in excess of that of the present cables, and it can be laid and maintained with no greater expense. Its use will vastly increase the speed of submarine telegraphy, and will have a most marked influence in lowering cable tolls. At the same time it brings us at last to a realization of the long-cherished dream of ocean telephony.

Think what it would mean to have Washington in telephonic communication with Panama, and business men in New York and London within talking reach of each other.



Gyroscope attachment for stabilizing automobiles.



View showing the normal position of the trailing wheel.

A Gyroscopic Stabilizer for Automobiles

A RECENT newspaper article contains an interesting account of a test made on a slippery surface to demonstrate the effectiveness of a gyroscopic attachment for preventing automobiles from skidding. The attachment is described as being made under Rutt patents. This probably refers to an English patent, No. 12,842, of 1908, granted to Alfred Rutt of London. In this English patent the gyroscopic principle causes a pivoted trailing lever to oppose any swerving or skidding motion of the vehicle. In operation, the rotation of a friction wheel *A*, driven by the fly wheel *B*, is transmitted by a flexible shaft *C*, to a spindle on which the gyroscope wheel *F*, is fast. When the car tends to skid, the lateral displacement resulting therefrom, causes the trailing rod *D*, by the friction of its trailing wheel on the ground surface, to assume an angular position and so swing a lever *E*, which carries the gyroscopic wheel *F*. This tilts the gyroscopic wheel from its normal plane of rotation and produces the combative force directed laterally against the frame of the vehicle in opposition to the side slip and operates to maintain or immediately restore the equilibrium of the vehicle.

The gyroscopic principle has been suggested as a means of securing stability and persistence of direction in various forms of vehicles. It will be recalled that a small gyroscope is provided within the shell of some forms of dirigible torpedoes to aid in holding the torpedo on its course. In 1877 a patent was issued in the United States for an aerial machine which embodied gyroscopic wheels, one with a normally horizontal axis and the other with a normally vertical axis for the purpose of preserving the equilibrium of the machine and preventing its upsetting. In 1888 C. Benz of Mannheim, Baden, Germany, secured a United States patent for a self-propelling vehicle in which he supports the fly wheel on a vertical axis whereby it will revolve in a horizontal plane so that "the vehicle is not only easily controlled but also the greatest safety is attained against capsizing."

Other instances in which the gyroscopic principle is utilized in an effort to secure stability in automobiles, will be found in numerous United States patents including Nos. 584,127; 637,750; 653,264; 734,283; 859,293, and 907,907, to which the attention of those especially interested in the subject is directed.

Medical Compounds from a Patentable Standpoint

AT one time, new medicinal mixtures of substances of previously recognized medicinal virtue, were regarded as patentable. In recent years, however, this view has been considerably modified by decisions such as that of Assistant Commissioner Fisher, rendered May 24th, 1890,

in the case of Crippen, in which a medicinal mixture was held to be

"wanting in patentability because it covered nothing more than such a compound of medicinal agents as could be made by the exercise of the skill of a physician."

The doctrine of this decision has been followed by the Patent Office tribunals, including the Board of Examiners-in-Chief (whose decisions are not published), and is generally applied to medical compounds which are made up of ingredients known as medicinal of which any physician is expected to make such selection as his judgment may dictate for the treatment of any case he may have in mind.

Darlington's Personal Property on page 227 says:

"It is doubtful if a mere prescription forming the body of a so-called 'patent medicine' (more properly a proprietary remedy, since they are usually not patented) really exhibits invention; for no matter how good and efficient (many are very good) it is still a question whether (other conditions being disregarded) where the result of medical education has brought in a formula for the cure of disease there is anything beyond technical skill."

Some substances not previously used in medicine may give patentability in mixtures in which they are employed. It must not be thought, however, that this is a conclusive test of patentability as it must be considered whether the new ingredient is essential and material in its effect on the mixture, also whether the mixture is a true combination or only an aggregation, for many medicinal mixtures are not patentable, because the mixture possesses no demonstrable effect other than that which would result from the ingredients taken separately.

Apart from medical compounds, processes of treatment have been held unpatentable. In the case of Brinkerhoff, decided July 5th, 1883, Mss. vol. 24, pp. 349, Commissioner Marble says:

"The methods or modes of treatment of physicians of certain diseases are not patentable; they are discoveries which may in a majority of cases under certain conditions accomplish certain results, but no particular method or mode of treatment under all circumstances and in all cases will produce upon all persons the same result, and hence to grant a patent for a particular method of treatment would have a tendency to deceive the public by leading it to believe that the method therein described would produce the desired result in all cases."

The Court in Morton v. New York Eye Infirmary, Fisher, vol. 11, page 320, held:

"The application of ether to surgical purposes was an effect produced by old agents operating by old means upon old subjects. The effect alone was new, and was a mere discovery, which, however novel and important, is not patentable,"

and suggested that the patent law is

"inadequate to the protection of every discovery by securing its exclusive control to the explorer to whose eye it may be first disclosed."

and

"Neither the natural functions of an animal upon which, or through which, a new force or principle may be designed to operate, nor any of the useful purposes to which it may be applied, can form any essential parts of a patentable combination with it, however they may illustrate and establish its usefulness."

As nearly as can be easily determined, about nine patents were granted during the past year for medical compounds.

Medical compounds, however, must not be confounded with chemical compounds, since definite individual chemical compounds are, if new, patentable, whether intended for medicinal use or for some other purpose.

A Puncture Proof Tire

ACCORDING to Consul James E. Dunning, Havre, France, Mr. George Longuemare of Havre has patented and put into practical use an invention for preventing punctures in pneumatic tires which he calls "a puncture-proof metal band for pneumatic tires." The chief features of the invention are:

A band of canvas covered with small hexagonal metallic disks. These disks are arranged to fit closely one against another, and are riveted to the canvas so as to form a flexible armor.

The band of canvas thus prepared is placed in a sheath of rubber. In order to safeguard the tire, this sheath is placed between the air-tube and the outer cover. The air-chamber cannot be punctured, and even cuts in the outer cover are in no way harmful. Experiments have shown that there is considerably less heating of the tire, and that resilience is the same.

Different experiments are said to have been made before responsible witnesses to prove that nails, broken glass, etc., cannot cause punctures when the air-chamber is thus protected, and the results are reported to the Consul to have been entirely in favor of the invention.

For example, two one-inch nails were driven into the outer cover and the automobile, with four passengers, was driven five miles before further examination was made. Then the tire was removed and it was found that the air-chamber had not been touched by the nails and that even the armored device had not suffered, the nails having met the quite imperforable steel disks.

Notes for Inventors

Honors to Theodore Timby.—On August 10th, Senator Clapp of Minnesota introduced in the U. S. Senate a joint resolution directing the Secretary of the Navy to commission a warship to convey the remains of Theodore Ruggles Timby from Brooklyn to Washington, D. C., on October 12th, 1911, for burial. The resolution recites that Timby, an American citizen, conceived the idea of and invented the revolving turret which was afterwards adopted by John Ericsson in the construction of the Monitor, and which made that vessel so effective in battle; and that his native State, New York, by a concurrent resolution, on May 2nd, 1890, regarded it as "a fitting if not an imperative duty of Congress to do ample justice in the premises and vindicate the genius that contributed so largely in rescuing the country from a grave peril." The resolution also recites that the Patriotic Association of America, the Monitor Association of Naval Veterans, and Naval Post 516 of the Grand Army of the Republic, appreciating the service rendered by Timby, are preparing, at their expense, to bury his remains in his family cemetery plot in Washington and they wish the commission of a warship be commissioned to convey the remains as a tribute of respect to his memory. It appears from the resolution that while the remains of Timby remain in the receiving vault of a cemetery in the city of Brooklyn unhonored and neglected, the construction of the Monitor brought John Ericsson fame and wealth and such distinguished honor that our Government, as a tribute to his memory, sent his body to Sweden, his native country, for final interment. After considerable discussion, the House Committee on Naval Affairs decided against recommending the adoption of the resolution, thus sustaining the position of Assistant Secretary of the Navy Winthrop, who thought it improper to thus give any basis for a claim on Congress for an appropriation in consideration of the services of Mr. Timby.

A New Kind of a Spinning Top.—An attractive spinning top is the subject of a patent, No. 999,839, to James R. Myers of Fairmont, W. Va., and has a disk and a tubular spindle molded integrally of glass. Translucent color circles are provided on the upper surface of the disk and a pin can be inserted in the spindle for spinning the top.

A Coating Machine.—A machine for coating articles is shown in a patent, No. 999,789, as the invention of Alfred R. Hussey of Harvard, Mass. There is provided a revolving form for the article to be coated and this is revolved in front of a number of atomizing nozzles which direct the spray against the sides and at a downward inclination against the top of the article, means being provided for supplying the coating liquid and air and for controlling the air supply.

A Reinforced Railroad Tie.—William D. Forsyth of Youngstown, Ohio, has patented No. 999,771, a reinforced railroad tie, having a rail fastening device, including a flanged sleeve, embedded in the concrete to receive and retain a non-metallic resilient bushing and this bushing is adapted to receive and retain an adjustable metallic split sleeve.

An Edison Storage Battery Patent.—Edison Storage Battery Company, West Orange, N. J., is patentee No. 999,762, as assignee of Thomas A. Edison, of a storage battery and process of treating same in which the process consists in soaking the pockets carrying the active material in a solution of bismuth tri-chlorid in acetone. The active material for the negative electrode of the battery comprises electrolytically active finely divided iron, and bismuth intimately associated with the active particles.

Listening to the "Innards" of an Automobile.—Leonard B. Gaylor of Stamford, Conn., has taken out a patent, No. 999,496, for a device for locating the defectively operating parts in automobile motors and other mechanism and including a hollow ear piece and diaphragm casing, open at both sides, and a rigid test rod, the unconnected end of which is made of noncombustible material. Gaylor seems to have invented an improved stethoscope for automobile use.

A Concrete Railway Tie.—A railway tie with a concrete body and a core-reinforce in the form of an I-beam, enveloped in the body, is shown in a patent, No. 999,449, to Joseph J. Harrell of Chicago.

Matches from Grass and Straw.—A London paper tells of a process, said to be in the experimental stage, for manufacturing a wood substitute from dried grass or straw, which is primarily intended for use in the manufacture of matches. At the conclusion of the process, which is described as including crushing and stripping the straw and compressing a flat layer between sheets of paper and subsequently molding the splints, the latter are cut to length and dipped in the match composition. When the scarcity of wood renders desirable the use of a substitute in match making in this country, a fruitful field will be opened to inventors.

A Novel Concrete Pile.—Two patents, Nos. 999,430 and 999,431, have been issued to Richard J. Beall, Jr., of Washington, D. C. The applications for these patents were filed in April, 1904. The patents relate to concrete piling, in which a tube, whose bore is unobstructed, has an enlarged separable point closing its lower end and when the point and tube are driven into the ground to the extent desired, the tube is withdrawn without the point, the opening above the point being filled with concrete deposited in the tube during the withdrawal of said tube.

Preparation of Milk.—The preparation of milk for delivery to customers forms the subject of a patent, No. 1,000,409, to Frederick W. Howe of Framingham, Mass. His method consists in filling the milk bottle with milk freshly drawn from the cow and withdrawing the gases and animal heat from the milk by a vacumn producing device, a permanent seal being applied to the bottle without the access of atmospheric air.

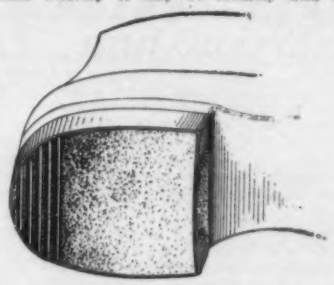
A New Conduit Creeper.—A creeper, which can be moved from one end of a conduit through or toward the other end of the conduit, has been patented, No. 1,000,825, to Henry G. Lehman of Windber, Pa. It includes a frame, having means for releasably engaging the conduit, and a carrier movable relatively to the frame and also having conduit engaging means, and jerk ropes are connected, one to the carriage and the other to the frame so that the carriage and frame can be advanced alternately, step by step, to feed the creeper through the conduit.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

DETACHABLE HEEL.—ANDREW W. CARLSON, 235 Front Avenue, Spokane, Wash. This invention comprehends a rubber heel of a peculiar conformation adapted for removable engagement with the heel of a boot or shoe. The inventor provides a rubber heel together with means whereby it may be securely held in



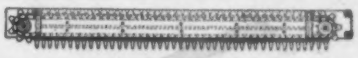
DETACHABLE HEEL.

position on the heel, a rubber heel being provided with an extending engaging means whereby it may be positioned on the heel. A perspective view is given in the engraving, showing the heel in position with the fastening means. The device is adaptable for use in cases where one may desire the rubber heel at some times during the day and its rmoval at another time. The fastening means comprises a bent number having inwardly extending portions and it is formed of risilient metal.

Of Interest to Farmers.

TRAP NEST.—F. H. SANBORN, Denmark, Maine. This invention provides means whereby it may be determined which hen has laid any particular egg and also to avoid any annoyance of the hen while on the next. It can be readily cleaned, to which end its several parts are detachable or separable, and which will effectually trap the hen without preventing the fowl from leaving the nest when desired.

ENDLESS CUTTING APPARATUS FOR MOWERS—J. H. ROSEAN, Columbus, Mont. The accompanying illustration pictures a cutting bar having a sickle bar moving continuously in one direction, thus dispensing with the wear and jar and heavy draft of the usual



ENDLESS CUTTING APPARATUS FOR MOWERS.

reciprocating bar, and lessening the cost of operation and maintenance of the moving machine. The cutter bar may be attached to any form of machine mower, and will run with great smoothness. By removing an upper plate, the cutting mechanism may be removed for any purpose, and the bar as a whole may be made of any suitable length. It is easily and cheaply operated and the mechanism is intended for a construction of long life.

Of General Interest.

ELEVATED CARRIER.—T. J. DRIVER, Honolulu, Hawaii. The object here is to provide a carrier for the transportation of field products, merchandise and the like, arranged to yieldingly support the cable which forms the track for the lower supporting trolley or carriage to run on, so that the cable is not liable to leave the support especially along abrupt changes in the grade of the track or cable.

INSULATING COMPOSITION.—W. RUMEL, Salt Lake City, Utah. This composition is an improved insulation for boilers, steam pipes, refrigerator pipes and appliances, and such other apparatus to which a non-conductor of heat is to be applied. The material is relatively cheaper than asbestos, and offers a more effective barrier to radiation between two mediums of different temperatures, although it is not claimed that the composition will withstand the ravages of fire.

RAILWAY CATTLE GUARD CAUSEWAY.—S. J. BILLINGTON and J. A. STEPHENSON, Ellis-ton, Mont. This invention provides a net-like structure arranged to form a shifting tripping platform to prevent the passage of cattle through the openings in fences provided for railway cars; provides means for preventing the entanglement of the parts of the platform with the structure of a moving car; and provides attaching devices for the rigid structures which are simple and durable.

ADVERTISING DEVICE.—H. A. ARMSTRONG, New York, N. Y. This invention has reference more particularly to a device in which a movable series of advertisements, notices, or other announcements, publications or the like, are successively presented to view, and which has means for advancing the series of advertisements and for reversing the direction of movement of the same, automatically, so that the series can be repeated.

HOD STAND.—S. H. MOORE, Phoenix, Ariz.—The aim of the inventor is to provide a construction of folding hod stand which can be

adjusted to any size of mortar or brick hod and hold such hod when applied to the stand at any desired angle. The stand in practice may be made of wrought iron of suitable size and dimensions to give the necessary strength for supporting the hod.

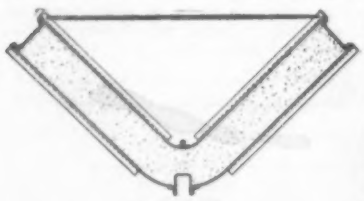
NON-REFILLABLE BOTTLE.—S. B. KULL, New York, N. Y. This non-refillable bottle is arranged to govern the discharge of the liquid from the bottle and to prevent unauthorized persons from refilling the bottle with spurious goods. For this purpose use is made of a valve in the neck and a plunger operating in the neck below the valve thereof, to allow of forcing the liquid through the valve on actuating the plunger.

SHEET HOLDER.—J. POHORALEK, New York, N. Y. The invention pertains to a holder adapted to support and secure a plurality of sheets in an assembled and readily accessible position, these sheets being of any suitable character, such as newspapers, blue-prints or the like. An object is to provide a plurality of clamping faces, between which any desired sheets may be secured and held in position by a lock.

CHIN SUPPORT.—A. F. HAMMOND, North Platte, Neb. This invention relates generally to implements used by undertakers and more particularly to a device adapted to bring the jaws into proper relation with each other when laying out a body. The aim is to provide a chin rest especially adapted to hold the jaws in such position that in the event of the body being laid out having false teeth the said teeth will be prevented from slipping.

PROCESS FOR MAKING PRINTING BLOCKS AND STAMPS.—ALFRED J. JARMAN, New York, N. Y. This invention relates to the process of making printing blocks and stamps from photographic negatives by the use of a specially prepared printing paper, a mold, and a die from which a bas-relief can be obtained, and an object is to provide an expeditious and economical process whereby innumerable representations of a photograph can be quickly reproduced.

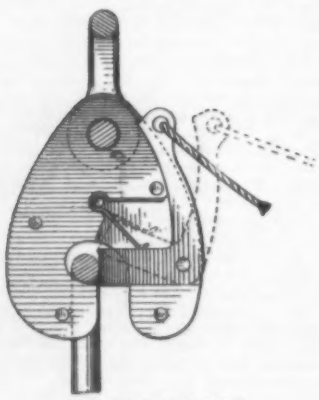
DAM MOLD.—THOMAS J. KELLY, Fon Du Lac, Wis. The purpose of this invention is to provide an improved form for abutments for dams, especially adapted for irrigation dams, wherein the abutment is so arranged that the gate while supported in an efficient manner may yet be lifted to release the water or lowered to hold the same. The dam to be built is preferably composed of two abutments



DAM MOLD.

of concrete, one on each side of the stream, and connected by the dam proper. A plan view of the improvement is given in the illustration and it shows an abutment completed and the form removed, and the other abutment with the form in place. The gate may be raised or lowered, and the forms may be made of any desired size, in accordance with the size of the dam.

BOAT RELEASING HOOK.—JAMES JORDAN, Box 83, Sydney, Nova Scotia, Canada. This hook is adapted to support a life-boat or the like, which may be attached to the boat proper



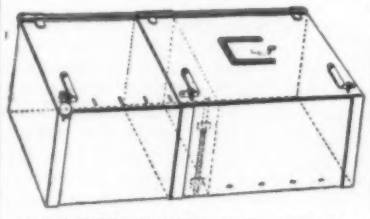
BOAT RELEASING HOOK.

or to tackle, and which is adapted to automatically release the boat from the supporting members by the simple movement of a catch. The invention provides a releasing hook in which the weight is supported on a stationary member, and in which the link engaging the hook is held in position on the supporting member by a latch, so that little or none of the pull on the link will be exerted on the latch, so that the latter will be readily operated, and yet in which the parts are so arranged that any tendency of the link to slip out of position will draw the latch down so as to more firmly hold it in place. The engraving shows a fragmentary view of a boat with the device attached thereto.

HORSESHOE.—N. SAWICKI, New York, N. Y. This invention has reference to horseshoes, the more particular purpose being to provide a shoe to be connected with the horse's foot without the aid of nails or other similar fastenings, and also without the necessity for any part binding tightly upon any sensitive portion of the hoof.

FOUNTAIN BRUSH.—W. L. PEELER, Greenville, Texas. In this improvement use is made of an apertured brush body provided with bristles, an apertured casing mounted to slide on the body, a valve adapted to normally close the appertures in the casing, a spring in the casing and adapted to engage the valve with the said casing, and a second casing adapted to constitute a cover for the brush body and a reservoir for a liquid or a holder for the fountain brush liquescent substance.

COLLAPSIBLE PACKING CASE OR TRUNK.—E. S. SHEPHERD, 1462 E. 94th Street, Canarsie, Brooklyn, N. Y. The illustration herewith shown pictures a case extended to its full capacity. Among the principal objects which the inventor has in view

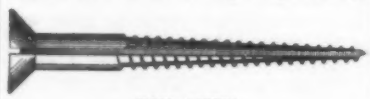


COLLAPSIBLE PACKING CASE OR TRUNK.

are: To provide a carton or case or trunk for trans-shipment of merchandise or other goods which may be adjusted to size to meet the emergencies of shipments and to economize the cost of handling by reducing the bulk dimensions of the returned or empty case; to provide a structure for boxes or cases of the ordinary character mentioned which is more durable than the form at present provided, and to provide means for locking the case which automatically locks or fixes the size of same.

Hardware and Tools.

WOOD SCREW.—R. DEWITT BURDICK, Linckiaen Center, N. Y. Inventor I. L. Messenger. A wood screw constructed in accordance with the present invention, differs from the ordinary screw in that the opposite sides thereof and longitudinally disposed thereon, channels are formed. The engraving illustrates

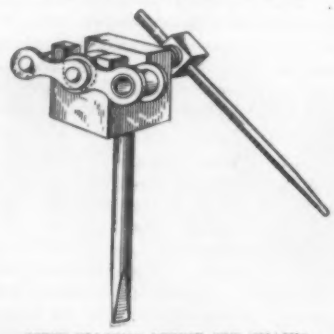


WOOD SCREW.

a side elevation and shows a screw in accordance with the foregoing. The invention provides a screw whose weight is diminished without impairment of its strength; provides a screw the threads whereof are sectioned to form a plurality of cutting edges for the threads and a relief passage in the barrel of the screw; and provides a screw the head whereof permits the use of a counter-sinking driver.

STROPPING MACHINE.—J. W. HAWKINS, Passaic, N. J. In this device a drum is provided having a blade supporting roller on each side of the drum, so arranged that when the rollers are engaged with a plane surface, the portion of the drum between the rollers will also engage and roll on the same surface, thus rotating the drum, and causing the rollers to hold the blades against the drum in stropping position.

RIVET MAKING DEVICE FOR CHAINS.—FRANK B. WIDMAYER, 2312 Broadway, New York, N. Y. This device may be readily carried in the tool-bag of a motor-cycle or automobile, for use in repairing the drive chain of



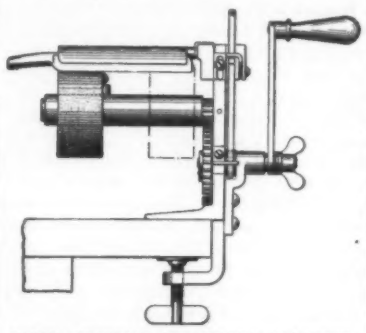
RIVET MAKING DEVICE FOR CHAINS.

the machine. It includes a punch and a hammer for driving the rivet out of the punch. The head of the hammer is so constructed as to receive and hold the chain, while the punch serves as a handle to turn a screw on the head of the hammer, to loosen the rivet preparatory to driving out the last. The device is shown in the engraving with the parts in position for starting a rivet from a chain, for which it is generally useful, but it is especially designed for use in the repairing of the drive chains of automobiles and motor vehicles.

HARNESS BUCKLE.—J. T. MERRITT, Jackson, Tenn. This inventor provides a buckle in which the tongue passes through the perforation in the article to be buckled instead of passing through it in a slanting direction, the ordinary form serving to wear the strap on one edge and to eventually cut it. Strain on the tongue is relieved by plates which serve to protect the tongue and also to clasp the strap over the side, this assisting in holding the strap in place.

RAZOR BLADE STROPPER.—I. KLEIN, New York, N. Y. The invention refers to a device for use in holding safety razor blades of various types during the operation of sharpening. The sharpener comprises a holder consisting of a plurality of leaves hinged together and having projections and recesses for securing the different types of safety razor blades so that they can be readily stropped or sharpened in any suitable manner.

RAZOR STROPPING AND HONING MACHINE.—CHRISTIAN ALTER, 500 E. 83rd Street, Manhattan, New York, N. Y. The object of the inventor is to provide a stropping and honing machine (a plan view of which is shown in the engraving) arranged to permit stropping or honing of ordinary razors



RAZOR STROPPING AND HONING MACHINE.

or the blades of safety razors in a very simple manner, it being only necessary to exchange a stropping wheel for a honing wheel when using the machine for stropping or honing purposes. For this result use is made of a wheel having a peripheral stropping or honing face and mounted to turn in either direction and to travel in the direction of its axis and a holder for the blade mounted to rock to present either side of cutting edge of the blade to the peripheral face of the wheel, according to the direction to which the wheel is turned.

PIPE WRENCH.—P. J. MCGUIRE, New York, N. Y. This pipe wrench embodies a flexible gripping member, ordinarily in the form of a chain at the end of a lever, and has in view such a wrench in which substantially no travel of the lever is required to draw the gripping member tight about the pipe or fitting after the member is applied, and which effectively grips the pipe or fitting for substantially the full circumference.

Heating and Lighting.

DRIER.—P. JACKSON, Macon, Ga. This invention is an improvement in driers embodying a rotary tubular conveyer, and has in view such an appliance in which the hot gases from a furnace are discharged through the conveyer in a direction opposite to the travel of the materials to be dried, the furnace and conveyer being arranged end to end, with the discharge end of the conveyer constructed to shower the materials through the hot gases and flame of the furnace.

LAMP BOX.—W. R. BOWLES, Hopkinsville, Ky. In this case the object of the improvement is to provide a simple and inexpensive box especially adapted for photographic work, and wherein a negative, picture or other object to be operated upon may be illuminated to the best advantage and with the proper character of light.

Household Utilities.

FURNITURE FOOT SOCKET.—O. TRINQUE, East Douglass, Mass. This invention provides a rest in the form of an adjustable cup head for the legs of a radiator or other article of furniture, the vertical dimension whereof may be varied; provides in a device of this character means for partially locking the device in set position; and provides a device which is simple, economical and durable in construction.

Machines and Mechanical Devices.

PROPELLER FOR AEROPLANES.—T. S. HARRIS, Waverly, Ill. Among the principal objects which the present invention has in view are: to provide a propeller wherein the rotation of the same is automatically governed; to provide means for manually controlling the adjustment of the governor; and to provide a simplified, efficient and durable construction for a propeller.

LOADED TRUCK COUNTING APPARATUS.—R. MCGAHEY, Walla Walla, Wash. This invention provides a platform and comptometer operatively connected therewith for tallying the succession of loaded vehicles or conveyances passed over the said platform; provides a platform to operate under conditions of load only; and provides a platform and comptometer connected therewith constructed and arranged in a manner economical, durable and efficient.

LIQUID PISTON VACUUM PUMP.—M. A. MOULIN, 303 Rue du Faubourg St. Antoine, Paris, France. This invention is characterized by the employment of a frictionless and loosely fitting piston whose tightness to gas is insured by a liquid without appreciable vapor pressure, which need not be lubricating, which by reason of its viscosity leaks through slowly in comparison to the speed of the system; the liquid escaped being afterward utilized to drive out gas filling the space where it is not wanted. A complete vacuum may be rapidly attained with little liquid, an important point when mercury is used.

AERIAL VESSEL.—E. A. NORRIS, Albany, N. Y. The object here is to provide an aerial vessel or aeronef, of the kind known as heavier-than-air flying machines, the vessel being provided with large sustaining surfaces capable of being moved to support the vessel, to elevate or lower the same, to propel and steer and to automatically restore the equilibrium of the vessel when struck by contrary air currents.

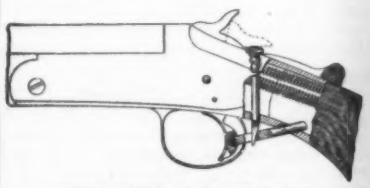
COPY HOLDER.—B. F. PEETZ, H. S. MCDANEL and N. W. THOMPSON, Portland, Ore. An object of this improvement is to provide a copy holder in which the copy may be fed forwardly by the mere act of operating the typewriter machine. It relates more specifically to novel means for effecting the feed of the copy in which the feed mechanism may be operated by the movement of the typewriter itself, or manually if desired.

VALVE.—S. STUCKY, Oxford, Ala. In this instance the purpose of the invention is the provision of a mechanism for use with ordinary form of outlet valve casing for closing the passage of the valve casing, when the valve is removed for any purpose, and wherein the said mechanism is normally held in inoperative position by the valve.

STOCKING FOLDER.—A. L. PATTERSON, Albemarle, N. C. The improvement is a means provided for folding stocking tops preliminary to sewing the same to form the hem at the top of the stocking and the invention includes means by the use of which the stocking may be folded accurately and on straight lines as desired, ready for sewing on a hemming machine. The stocking tops may be folded to any desired width of hem which may be varied according to the length or extent of movement of the blade.

RIVETING MACHINE.—H. LLOYD, Lexington, Ky. In this patent the object of the invention is to provide a very powerful hand operated device which will be light, compact and handy, easy to operate, and consisting of but few parts. The device is a die having an anvil co-operating therewith provided with means for holding a rivet in position to co-operate with the die to perforate a sheet of metal, the hammer and anvil being further provided with means for heading the rivet.

FIRING MECHANISM FOR GUNS.—ETHAN ALGER, 214 Arizona Avenue, Lorain, Ohio. Mr. Alger's invention has reference to firing mechanism for guns, and it has for its object



FIRING MECHANISM FOR GUNS.

the provision of means for firing a gun which may be readily actuated with heavy guns or warm mittens. In hunting in winter weather it is very difficult to pull the trigger when gloves or mittens are worn, and without gloves or mittens the fingers become too numb to permit of the firing of the gun. The invention overcomes this difficulty, and permits the hunter to fire the gun by pressing a pin which is connected with the trigger. The pin has a head and it can be readily thrust downward. The lock with the pin improvement is shown in the engraving.

DIPPER TRIP FOR STEAM SHOVELS.—A. H. GEDDES, Empire, Canal Zone. This invention has reference more particularly to the combination in a steam shovel having a dipper, a door, therefor, and means for operating the dipper, of a latch for the door, a cylinder to receive a fluid under pressure, a piston in the cylinder, a pivoted lever operatively connected with the piston, an operative connection between the lever and the latch whereby the pistor can be actuated to release the door, and a fixed stop to limit its movement.

COMBINED HANDLE AND PULLEY FOR CREAM SEPARATORS.—F. A. SHOBERG, Hot Springs, S. D. It is important that centrifugal cream-separators shall be run at a uniform speed, and, since the gas engines or other

motors ordinarily employed for driving them often rotate at varying speeds, or, in common parlance, have a "jerky" motion, spring attachments have been devised for connecting the hand-wheel or pulley with the shaft of the separator. Mr. Shoberg's invention is an improvement in this line.

ROTARY PUMP.—A. P. SMITH, Winnemucca, Nev. This improvement provides a pump wherein the lifting power is supplied by weighted members which may be varied to harmonize with the conditions under which the pump is working; provides a mechanism wherein the lift of the water on the intake side of the pump is produced by the fall of the weighted members; and provides a mechanism the operation whereof is balanced to cooperate in the function of the pump.

HYDROSTATIC MOTOR.—J. G. MECHAM, Oakland, Cal. This invention has reference to hydrostatic motors, and has for an object the provision of a motor of this character with means so that the lifting force of water is concentrated and delivered at one point and readily converted into motive power for operating various power driven machines.

Prime Movers and Their Accessories.

PACKING FOR PISTON RODS OR THE LIKE.—G. H. ROBINSON, 93 Grace Church Street, London E. C., England. This invention pertains to packing for piston rods or the like, and the object is to provide a packing which, besides being capable of holding a thoroughly fluid tight joint, is easy to construct, capable of conforming to the shape of the piston-rod or other moving part in connection with which it is being used, and very durable.

ROTARY ENGINE.—W. ALEXANDER, 4 Rosenau Crescent, Battersea, London S. W., England. This invention has reference to fluid pressure engines (motors, pumps, compressors, blowers and the like) of the rotary type in which there is an inner revolving or rotative drum, within an outer rotative drum or casing and in which abutments, hinged to the drum or casing, are arranged to move in the spaces between the inner and outer drums.

DAMPER.—L. SLIGER, Indianapolis, Ind. In this instance the inventor provides an air inlet made somewhat upon the principle of an iris diaphragm, and so arranged as to be easily connected with the throttle and actuated by movements thereof, the iris diaphragm being also adjustable at the will of the operator for the purpose of varying its character.

Pertaining to Recreation.

AMUSEMENT APPARATUS.—A. E. WEST, Portsmouth, Ohio. Mr. West's invention is embodied primarily in a pivoted circular platform adapted to oscillate vertically, and whereon a car or truck is adapted to travel, the required impetus being derived from the motion of the platform, which is produced by hand power, a spring, or any other form of motive power.

Railways and Their Accessories.

RAIL CHAIR AND BRACE.—O. PAYZANT, New York, N. Y. An object here is to provide means by which both the running rail and the guard rail can be securely positioned upon the tie, which permits the rails to be removed without displacing the chair itself, which tends to lengthen the life of the ties by obviating the necessity of pulling and driving the spikes or holding bolts in the removal of the rails and which obviates the necessity of providing drill or other holes in the rail webs.

MACHINE FOR GROOVING RAILWAY SLEEPERS.—F. ALTENSTEIN, Budapest, Austria-Hungary. This invention relates to machines for cutting into the upper surface of the sleeper or tie transverse grooves designed to receive the tie plate and relates more particularly to machines in which the tables supporting the ends of the blank during working are first positively forced downward into their lowermost position in which the blank is pushed upon them, whereon each of the tables is raised by weights or springs for bringing the blank into the proper position relatively to the cutters.

Pertaining to Vehicles.

HOIST.—H. L. MCCOY and W. B. BOATRIGHT, Mathis, Texas. The intention here is to provide an easily operated device of the character specified for lifting vehicles, especially motor vehicles of considerable weight, by means of which the heaviest vehicle may be lifted with a small expenditure of force, and may be held in elevated position and without changing the relative position of the parts of the vehicle.

REED FOR MOTOR HORNS AND THE LIKE.—ETIENNE TESTE, 18 Rue des Bois, Paris, France. The object of this invention is to remedy numerous defects and it consists in providing a reed for motor horns and the like whereof the different parts can be detached with the greatest ease, either for cleaning purposes, or for restoring the curvature when damaged.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE SOCIAL DIRECTION OF HUMAN EVOLUTION. By W. E. Kellicott. New York: D. Appleton & Co., 1911. 249 pp. Price, $1.50.

In ministering to the welfare of the community, the philanthropist and social reformer, like the physician attending the individual, faces a double problem. First he must correctly diagnose the evil which he seeks to remedy. Once the trouble is recognized, and its nature properly understood, there remains the task of discovering or devising a suitable treatment. There have never been wanting those who have labored with self-sacrifice and in truly altruistic spirit for the good of the less favored strata of human society, and especially within the last century or so the systematic care for the sick and defective has developed to a stage of excellence which we may well witness with gratification. But while there can thus be no doubt as to the good motives which have been at work, the question has been raised, particularly by the advocates of "eugenics," whether some of the steps taken have not been based on a false or at least incomplete diagnosis of the trouble. It is pointed out that our asylums and hospitals and other philanthropic institutions, indeed, do a noble work for the individual, but that the benefit thus conferred is evanescent, lasting at best for a lifetime, and requiring ever-renewed efforts in each generation. We are combating the symptoms, instead of seeking to eradicate the disease. Says the author:

"If we could by education, by legislation, or by social effort, change the environmental conditions, would the race at once rise to a markedly higher standard of physique and mentality? Much, if not the whole battle for social reform, has been based on the assumption that this question was to be answered in the affirmative. No direct investigation has really ever been made of the intensity of the influence of environment on man. To modify the obviously repellent was the immediate instinct of the more gently nurtured and controlling social class. Was this direction of social reform really capable of effecting any substantial change? Nay, by lessening the selective death rate, may it not have contributed to emphasizing the very evils it was intended to lessen?"

To show how intricate some of the questions involved are, new measures taken with the very best intentions may lead to wholly unlooked-for results. "We might point out that several movements apparently of high social value have been attended by a curious and largely unforeseen back action. Thus the enforcement of certain forms of employers' liability laws has led to discrimination against married persons by large employers of labor, and a premium thus put upon non-marriage. The result of child labor legislation has been in some cases an enormous rise in the death rate of young children among the classes concerned, indicating that the children receive less care, now that they have ceased to be a prospective family asset, and have become chiefly a burden for many years. In other cases the result has been so serious a limitation in the birth rate that communities are dying out and factories are closing for want of sufficient help."

There can be little doubt that the right standpoint from which to attack the problems involved is that of eugenics. In the volume under review the author brings before the reader in logical sequence the aims, the scientific (biological) basis, and the "programme" of eugenics. Naturally much attention is paid to a discussion of the phenomenon of heredity, and Mendel's law of ancestral inheritance. How terrible is the inherited bias for crime and ineptitude is shown by the records of the Jukes family of New York State. This family is traced back to 1720. Of 1,200 members whose history is known, 300 died in infancy. Of the remaining 900, 310 were professional paupers; 440 were wrecked by their own diseased wickedness; more than half of the women were prostitutes; 130 were convicted criminals, 60 habitual thieves, and 7 murderers! They cost the State over a million and a quarter dollars, and this cost is still going on.

These subjects are now, and rightly so, much in men's minds, and Prof. Kellicott's book is well calculated to form a valuable addition to the growing literature on eugenics. The value of works of this kind, which bring before the people at large the vital facts and principles of a topic of supreme importance, can hardly be over-estimated. In particular, Prof. Kellicott's book commends itself for its conciseness, the apt way in which the essentials are picked out and clearly laid down. The presentation is in every way attractive, and the book should prove interesting and most profitable reading to all classes.

HOW TO READ PLANS. By Charles G. Peker. New York: Industrial Book Company, 1911. 12mo.; 104 pp.; illustrated. Price, 50 cents.

The writer answers the question, "How can I learn to read a drawing?" by saying that the best way is to learn to make a drawing. Architectural lay-outs in plan, elevation and section are simply illustrated and described, with an explanation of the various markings and instruction as to following to scale. The methods of designating walls, floors, columns, windows, the swing of doors, and so forth, is given, with a list of the symbols and abbreviations in use. There is a complete set of plans for a six-room frame cottage, and in conclusion the student is warned against some mistakes he is likely to make in his first attempts at plan-reading.

IDRAULICA. Ing. Dott. Edgardo Zeni. Milan: Ulrico Hoepli, 1911. 16mo.; 503 pp.

The handbook begins with a rather extensive bibliography of the subject, and follows this with the tables and formulas in common use. Other sections of the manual take up the various branches of the subject in logical order, leading the reader on from the constitution and properties of water and its behavior under natural conditions, to the principles and processes of hydrostatics and hydraulics. Two hundred and fifty engravings and a large insert add to the manual's attractiveness and enhance its value.

MANUALE DI LIVELLAZIONE PRATICA. Compilato da Mario Veglio. Milan: Ulrico Hoepli, 1911. 12mo.; 130 pp.; 47 illustrations.

A concise description of the various types of instruments in use, with their methods of application to the common exigencies and problems of field work.

CONCRETE WORKERS' REFERENCE BOOKS. By A. A. Houghton, New York: The Norman W. Henley Publishing Company, 1911. No. 3. Practical Silo Construction. No. 4. Molding Concrete Chimneys, Slate, and Roof Tiles. No. 5. Molding and Curing Ornamental Concrete. No. 6. Concrete Monuments, Mausoleums and Burial Vaults.

These booklets represent a part of a series of practical monographs on popular concrete subjects. The author's purpose has been to present not only the usual types of construction, but to fully explain and illustrate molds and systems that are not patented, which are equal in value and often superior to those restricted by patents. Each book is fully illustrated and the subject is treated in plain English.

UNSOUNDNESS OF MIND. By T. S. Clouston, M.D., LL.D., F.R.S.E. New York: E. P. Dutton & Co., 1911. 8vo.; 360 pp.; 14 illustrations.

Unsoundness of mind is here treated in its very broadest aspect; for Dr. Clouston's book covers all that vast region, psychological, sociological, and pathological, that lies outside of the normal mind. Among the diseases which a physician might classify as those of a mentally abnormal person are many that cannot be sharply defined from normal mental states. Because there is no reliable test between soundness and unsoundness of mind, the author has necessarily included in his book much that is more charitably called eccentric. The book as a whole is an excellent example of good popular scientific writing of a kind that will do much to enlighten the public on special problems which are only vaguely appreciated and to which a certain amount of odium is unfortunately attached.

THE BIRTH OF WORLDS AND SYSTEMS. By Prof. A. W. Bickerton. London and New York: Harper & Brothers, 1911. 16mo.; 162 pp.

More than thirty years ago Prof. Bickerton published in the New Zealand Philosophical Institute a theory to account for the origin and life history of new stars. Prof. Bickerton's viewpoint that these celestial flashes result from the impact of two celestial bodies has been adopted by many scientists of note, chief among whom is Svante Arrhenius, who, in his book "Das Werden der Welten" and his review of cosmogonies has ingeniously applied the theory and shown its cosmic consequences. In the main these conclusions are much the same as Prof. Bickerton draws in the excellent little book before us. Although the theory is not yet generally accepted, it certainly explains in a most plausible way a number of astronomical phenomena that have long been puzzling.

THE PRINCIPLES OF ELECTRO-DEPOSITION. A Laboratory Guide to Electro-Plating. By Samuel Field, A.R.C.Sc., F.C.S. New York: Longmans, Green & Co., 1911. 8vo.; 383 pp.; illustrated. Price, $1.80 net.

The writer believes that many who are interested in electro-plating are in need of a more thorough knowledge of fundamental principles. The opportunity of attending classes is by no means open to all, and the present volume is offered as at least partly filling the need of special instruction. An elementary knowledge of chemistry is taken for granted. Details of shop practice are but briefly mentioned. The exclusive use of the metric system is not insisted upon. Apparatus, standard solutions, tools, and processes are explained at length and there is a comprehensive appendix of tables and general information.

GRAMMAR SCHOOL READER. Book One. By William H. Elson and Christine Keck. New York: Scott, Foresman & Co. 12mo.; 344 pp. Price, 50 cents.

The selections brought together within the covers of the Elson Reader are all old favorites. The arrangement follows an ascending scale of difficulty and literary quality, and there are review questions, words and phrases for study, and three-line biographical notes on the authors of the selections. We protest against the inclusion of "Casabianca," which has no poetic or literary value and has been parodied so often that it now appeals only to the child's sense of humor. If it carries any moral, it must be to the effect that unintelligent obedience brings its own punishment.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12529) F. L. R. asks: What makes a horse hair when placed in still water wiggle like a snake? When one holds a hair of a horse in the hand it doesn't move a particle, but placing it in water starts the movement. What I would like to know is: what furnishes the power for the movement? A. Any motion a horse hair may have when put into water is caused by its power to absorb water and to bend or twist as the water causes the hair to swell on one side more than on another. This will take place in the air. If you hang a long hair by one end and tie to the lower end a light rod of wood or a piece of straw perhaps six inches long, you will find that it will twist back and forth from day to day.

(12530) C. T. C. asks. In an air pump that drawn out 2 inches makes a practical vacuum, the outside air pressure is said to be 15 pounds to the square inch. Now suppose the piston to be drawn out to 4 inches and 6 inches and 8 inches, is the air pressure on the piston any more at 8 inches than it is at 2 inches? A. If there is no space whatever between the piston and cylinder head—no "clearance"—there will be a perfect vacuum (theoretically) behind the piston the instant after it commences to move, and an unbalanced pressure of 14.7 pounds per square inch on the opposite face of the piston, and this pressure will not increase as the piston is drawn out. In fact, the atmospheric pressure may be considered constant, while the pressure behind the piston, equal to atmospheric at first, drops instantly as the piston begins to move.

(12531) H. L. W. says: Can you lower the temperature of ice below 32 deg. F.; if so, what ratio does the lowering the temperature of the surroundings bear with the temperature of the ice? A. Ice, like any other solid, takes the temperature of the place in which it is, when that temperature is below its melting point. In a cold region when the temperature is at zero, a block of ice will cool to zero, just as the stones do and as rapidly according to some experiments, while others seem to show that it will cool less rapidly than the stones. Water, as a solid, has the properties of other solids. Its melting point is low as compared with most solids, and for that reason, we suppose, people do not usually associate it with solids.

(12532) H. C. says: 1. I read somewhere, some years ago, that the moon possessed a small satellite, some few miles in diameter, occasionally visible. I have seen no other reference to it and cannot now place the reminiscence. Is this a fact? A. 1. No satellite of the moon is known to exist. There is no mention of such a body in the astronomies. 2. Why do the etheric waves used in wireless telegraphy bend round the earth? Why do they not take their way through the ether altogether irrespective of material bodies? A. 2. The antenna of a wireless telegraph apparatus is equivalent to one-half of a Hertzian oscillator, the other half of which is the earth. A complete Hertzian oscillator does give off waves which go through space like light waves independent of the earth. A grounded oscillator gives off half waves, the lower part of which are not closed lines, but terminate in the earth, and cannot separate from it. They therefore follow the contour of the earth's surface. They are also thought to produce or to be accompanied by alternating currents of electricity in the earth's surface. These electric currents must overcome the resistance of the material through which they are moving. This resistance will be less in water or moist earth than in dry materials, so that signals can be transmitted to a greater distance over water than over land. In the day time the sun ionizes the air, rendering it, as it were, more opaque to ether waves, thus rendering communication more difficult than in the night time. Both these well-known difficulties in wireless telegraphy are due to the fact that the etheric waves do not move as free waves in space, but employ the earth for one side of the wave as a material point of attachment. See Poincare and Vreeland's Maxwell's Theory and Wireless Telegraph, which we will send for $2.00 postpaid.

An interesting experience with Polarine

Saurer Motor Company
30 Church Street, New York

August 11, 1911

Standard Oil Company,
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Eastern Sales Manager

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Standard Oil Company
(Incorporated)

The New British Dreadnoughts

(Concluded from page 226.)

accommodation is 3,500 tons of coal with considerably over 1,000 tons of oil fuel in addition; the subsidiary engines are driven by steam and not by Diesel engines as in previous battleship-cruisers. In spite of the high horse-power and heavy battery, sufficient proportion of weight has been found to adequately protect the ship against shell fire and submarine explosion. The belt is of 9¾-inch Simpson steel, thinning to about 4-inch at the bow and stern, leaving a space of 20 feet unprotected at the ends, the hull being minutely subdivided in lieu of the armor. The barbettes are of 11-inch plate, the hoods being 12-inch; a protected deck of 2¾ inches and subdivision by bulkheads is utilized on similar lines to the "Orion." The conning-tower is of a new and splinter-proof pattern, there being no apertures in the tower itself but a large dome-shaped projection rises from the rear of the roof provided with slots giving an almost all-round view. A second tower is situated aft of the after wireless telegraphy pole-mast.

Taking into account the speed, gun power, and protection of this ship, it is debatable whether the fighting power is not equivalent or superior to that of the "Orion." It must be admitted that the British Admiralty and their board of construction have evolved in these ships war-machines with an unprecedented potential power of destruction in view of the limitations imposed upon them by cost and displacement. The ships now building, or authorized ("King George V." and "Queen Mary" classes) are of the same general type as the "Orion" and "Lion," but improvements have added somewhat to the displacements. What further perfection and also whether the limit of size has yet been attained in these huge ships can only be shown by the passage of time.

Artificial Life

(Concluded from page 231.)

of foam. The microscope does not tell us all that we should like to know—and it tells us one thing at one time, and other things at other times. It is quite possible that the "structure" of protoplasm is different in different organisms; or that it is different in different parts of the same organisms; or that it is different within the same cell under different conditions. At any rate, Prof. Bütschli, to demonstrate his idea of the "alveolar" or foam-like structure of protoplasm, mixed some finely powdered potassium carbonate with olive oil that had been heated from 125 to 140 deg. F. The oil becomes partly saponified, producing an acid. This acid reacts on some of the carbonate, producing minute bubbles of carbon dioxide. Under the microscope a drop of this frothing mixture looks like a speck of protoplasm, and the movements in it even resemble the streaming in a living cell.

Some fifteen years ago these experiments were hailed by certain journalists as successful attempts to produce artificial life. But no one who knows anything about the problem, least of all Prof. Bütschli, thought that these experiments had anything to do with the creation of life. The experiments were successful in the sense that they gave us a working model made of familiar materials, to help us understand the minute structures and movements within the cell. How hard error does die is suggested by the fact that these experiments have been described over and over again in all grades of publications as a method for making "artificial protoplasm" until this very year.

After the fact of cell-structure in organisms had become well established, one of the problems that interested the experimentalists was that of the growth of the cell wall, which to all appearances is not itself alive. To test the theory that growth is produced by a stretching of the membrane with subsequent deposition of new material in the interspaces of the old wall, Moritz Traube carried on some very suggestive experiments. He allowed a solution of sugar and gelatine to come in contact with a solution of tannin through the narrow opening of a small tube. Now as soon as the tannin touches the gelatine it forms a membrane through which the water may easily pass, but through which the sugar cannot pass at all. The globule within the membrane continues to absorb water from the tannin solution by osmosis, stretching the membrane. The membrane *grows*, and under certain circumstances puts forth branches in various directions, the whole taking in the appearance of some weird plants or "sea-weeds."

Traube's further experiments, from 1865 on, and those of others, extended our knowledge of osmosis, threw some side lights on the mechanism of the cell-growth, and furnished amusement to many persons, for these osmotic gardens are curious and somewhat mystifying. But no biologist has in all these years suspected that Traube's phenomena were in any way related to "artificial life" until a few years ago Dr. Stéphane Leduc, professor of physics in the medical faculty of the University of Nantes, announced that he had discovered the physico-chemical foundations of life. He presented before the French Academy of Sciences a large number of demonstrations, in which he made "plants grow from artificial seeds." These seeds consisted of sugar plus some salt that would form a precipitation membrane with the substances of his growing medium. For example, copper sulphate in a "seed" would cause growths in a solution of potassium ferrocyanide. These growths were in no way different from those obtained by Traube and others, except that Leduc used a larger variety of substances in his experiments than had been used by other experimenters. Anyone can make for himself a garden of such "artificial plants" with very little trouble. Perhaps the easiest way is to place at the bottom of a jar a number of crystals of salts of heavy metals (e. g., sulphates of copper, iron, zinc, cobalt) and carefully pouring over them a 10 per cent solution of sodium silicate or "water glass." The insoluble silicates of the metals will form the membranes, osmosis will cause them to strefch, variations in the density of the medium will cause irregular branching, and the colors of the salts within the membranes will give a further resemblance to "plants." (Fig. 1 and Fig. 1a.)

Leduc went farther, however, and produced imitations of living structures down to the smallest details. By placing a drop of colored salt solution into another solution of lower concentration, he produced "artificial cells." More definite cell membranes are produced by placing drops of 10 per cent solution of potassium ferrocyanide in a 10 per cent gelatine solution. (Figs. 2, 3.) The appearance of nuclear division within a cell he produced by placing two drops of some solution near each other within another solution. (Fig. 4.) That all these phenomena are due to osmosis or diffusion is well known to all physicists; that they are not in any true sense identical with "growth" and "nuclear division" may be known only to the student of biology. Among other demonstrations made by Leduc in this connection was the formation of a "field of force" by the diffusion of liquids of different densities. (Figs. 5, 6, 7.)

That the "artificial life" of Leduc had no real bearing on the fundamental physiological problems has been shown repeatedly, and Prof. Leduc has in later statements denied that he confused his phenomena with life processes, although his original confusion is on record in the proceedings of the Academy. Perhaps the best analysis of Leduc's results is that of Prof. Maurice D'Halluin, director of the physiological laboratory at the University of Lille. This experimenter not only repeated all of Leduc's "demonstrations" but even showed that the various weird forms assumed by the "artificial plants" could be controlled by changing the concentration of the solutions, or by changing the proportions of the different materials used. Nevertheless we still find fairly frequent references to Leduc's overstepping the threshold between the non-living and the living by means of "artificial seeds."

In the spring of 1905 we had another "artificial life" sensation in the announcement that Mr. John Butler Burke, "of the Cavendish Laboratory of Cambridge University," had obtained some curious, life-like structures from the action of radium upon sterilized bouillon. Mr. Burke was following up a sugges-

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tion made many years before by Prof. E. Pflüger of the University of Bonn, that the essential difference between living protein and non-living protein lay in the fact that in the former oxidation or transformation of energy is *internal*, and that this internal oxidation could perhaps have been induced by cyanogen, a compound of carbon and nitrogen which was probably produced during the incandescent stage of the earth's history. Having failed to induce phosphorescence or other indications of the internal transformation of energy in organic substances by means of cyanogen, Mr. Burke resorted to radium.

The test-tubes containing gelatine and beef-extract in the proportions used for bacteriological cultures were properly sterilized, and a minute quantity of radium chloride or bromide was added. The appearance of the gelatine changed, suggesting bacterial growths. Under the microscope there were seen tiny roundish bodies that increased in size, divided and moved about slightly! This was certainly life-like. In order to make sure that they were not bacteria due to contamination, the tubes were examined by Dr. Sims Woodhead, professor of pathology at Cambridge. This authority declared they were *not* bacteria at all. They were not even living things, for they dissolved in water; they disappeared entirely after standing in diffuse daylight for a little while, to reappear after a few days of darkness. Moreover, on being transferred to fresh bouillon, they did not increase in numbers.

But the world was clamoring for artificial life; Burke could not lose so good a lead. Instead of calling his new discovery bacteria, which they were not, he called them "radiobes," implying that they were life-like things produced by radium. They were unlike any other living thing, so Burke set to work and elaborated a new definition of life, so that the radiobes could fit in. Otherwise he should not have created "artificial life."

That the radiobes were not living things, in the accepted sense of the word living, must be obvious to nearly everyone. But what are they then? Prof. Sir William Ramsay explains these structures are due to bubbles of hydrogen and oxygen gas (arising from the decomposition of water by the radium salt) and "radium emanation." The "growth" is due to the continuous production of more gas by further decomposition of water by the emanation within the bubble; the expansion of the gas might also lead to the breaking up of the bubbles into two or more. (Fig. 8.)

Fig. 8.—Radiobes in various stages of division. After Burke.

At any rate, the water-soluble radiobes are not alive, and it was later found that they could be produced in the bouillon by other substances besides radium, such as salts of barium, strontium, and lead. "Radiobes" produced by these substances also have "nuclei" consisting of insoluble sulphates of the metals used.

The failure of scientists so far to produce "artificial life" is not to be charged against the science of biology. Very few of the attempt to produce "artificial life" have been made by biologists, who realize too well the complexity of the problems involved. The biologists will be satisfied for a number of years to come if they succeed merely in analyzing what goes on in a living cell, in terms of physical and chemical processes. From time to time they will attempt to imitate a structure or a process by means of a working model; but they will not speak of artificial life until they are quite sure of all the conditions that play a part in this most intricate of phenomena.

The Solar Constant.—In the *Proceedings of the American Philosophical Society*, May-June, 1911, Mr. C. G. Abbot defines the solar constant as "the number of degrees by which one gramme of water at 15 deg. C. would be raised, if there should be used to heat it all the solar radiation which would pass at right angles in one minute through an opening one centimeter square, located in free space, at the earth' mean solar distance." Experiments were begun about 1835 by Pouillet and Sir John Herschel for the measurement of this great constant of nature, and the investigation has been continued by Forbes, Crova, Violle, Radau, Langley, K. Angström, Chwolson, W. A. Michelson, Rizzo, Hansky, Scheiner, Abbot, Fowle, and others. The difficulty of the problem is shown by the fact that until a few years ago entire uncertainty prevailed as to the value of the solar constant, between the limits of Pouillet's value, 1.76 calories, and Angström's value, 4.0 calories per square centimeter per minute. The author and his colleagues have made over 400 observations with special apparatus, including the silver-disk pyrheliometer, an absolute water-flow pyrheliometer, and the recording spectro-bolometer, at Washington, Mount Wilson and Mount Whitney, to determine the value of the solar constant and its possible fluctuations; and they now announce a mean value of 1.922 calories, which may prove to be 1 or 2 per cent too low, as the observations have been made mainly near the time of sunspot maximum, and hence of diminished radiation. This value is, moreover, subject to fluctuations amounting to about 8 per cent, at irregular intervals of a few days; and these fluctuations are thought to indicate a true variability of the sun itself. In other words, the solar "constant" is probably variable.

The Current Supplement

WE have previously had occasion to refer to the fact that the United States Post Office is finding it economical to do some of its own printing, instead of giving out the work to contractors, as heretofore. In the current issue of our SUPPLEMENT, Mr. Gunnaway describes the arrangements which have been made for printing money orders on the government's own presses.—In the second instalment of his article on the Great Star Map, Prof. Turner deals with the subject of "Star Counting." A note on the Variation in the Purchasing Power of Gold should prove of general interest.—We like to keep track, not only of progress at home, but also of the course of events abroad. An article on the electrification of suburban lines in the British capital is published with this object in view.—We have seen the automobile invading a great variety of fields of usefulness. The motor car to the rescue is the modern cry when fire threatens property and life, as is illustrated by an article on a new auto-fire-engine.—The article on Practical Aspects of Printing Telegraphy reaches its seventh instalment in this issue.—The Mechanical Handling of Freight is a most important technical problem, to the solution of which new contributions are added every day. One example of this is shown in an illustrated article.—Factory Economy is the guiding principle ever before the eyes of the works superintendent. A description of an immense superheater utilizing waste heat and installed in one of the plants of the United States Steel Corporation is interesting in this connection.—An article from the pen of the great genius, Prof. Wilhelm Ostwald, on the Biology of the Savant, bring us one of his lucid studies in the psychology of great personality.—The extraction of crude cocaine and its refining process is described in an article derived from the *Engineer*.

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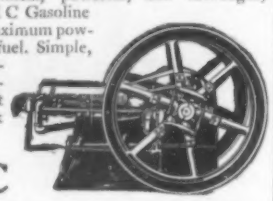

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Aeronautics

A New World's Record Flight With a Passenger.—Besides the new height record made by Beachy at the Chicago meet, Wm. Beatty set a new mark for endurance with a passenger by remaining aloft with Fred Wagner, a photographer of the Chicago *Tribune* no less than 3 hours, 42 minutes, 22 1/5 seconds. The new record beats by 23 minutes that made by Amerigo with an Aviatik aeroplane in Germany some time ago. Beatty accomplished the feat with a Wright biplane.

Aerial Postal Service in England.—The English Postmaster-General has arranged for the inauguration of the "First United Kingdom Aerial Post" in London on September 9th. The aerial mail will be collected from special letter boxes located in several department stores. It will be taken by automobile to the Hendon aerodrome, whence an aeroplane will carry it to Windsor Castle in less than half an hour. From the post office at Windsor Park the letters will be sent in the regular way to all parts of the world.

Flying in a Wind.—Perfect mastery of their machines in half a gale by the Curtiss aviators, Beachy, Ely and Ward, and the ability to fly and climb to great heights when even the Wright machines were unable on account of the wind, was the surprise of the Chicago and Boston meets. At the former Beachy and Ward flew high and long—the former attaining and altitude of 7,917 feet and flying till his fuel was exhausted—when five Wright machines remained on *terra firma*, while at Boston Beachy and Ely made fine flights after the 33-mile race to the lighthouse and back had been postponed on account of the wind.

Aviation in the Sahara.—The French government is pushing forward its plans for providing communication by aeroplanes in the Sahara, especially for military purposes. In accordance with the recommendation of the military committee of the Ligue National Aérienne, and of General Bailloud, commanding the 19th army corps, a post for aeronautical studies will be established in the autumn of 1911 at Biskra, 140 miles from the coast. Particulars of this enterprise have been published in *La Nature*, from which it appears that five aeroplanes will be provided, four of them to be of metal, in anticipation of the fact that wooden apparatus would be seriously warped by the hot climate. The staff will consist of three aviators, under the command of Lieut. de Lafargue, and thirty other men (mechanicians, etc.).

A New Record for the Michelin Cup.—Competition remains brisk for the Michelin Trophy, which is to be awarded this year for the longest continuous flight over a 62-mile circuit. Stops are permissible to take on fuel, etc., the thing that counts being the distance covered from the start to the finish of the attempt. On the 9th of last month Vedrines set out to fly 1,000 kilometers. Starting at 4:03 A. M., he flew until 3 P. M. on his Morane monoplane, covering 811.2 kilometers (503¾ miles), of which 800 kilometers (496.8 miles) count as the record. The time, including two 50-minute stops, was 10:56:42, and the average speed 57¾ miles an hour. On the 26th ult. M. Helles, in a 15-hour flight, covered 1,200 kilometers (745.6 miles) on a Nieuport monoplane that averaged 50 miles an hour including stops.

Recent Altitude Records.—Beginning with the record height of 3,300 meters (10,826 feet) scored by Capt. Felix a month ago, a number of altitude records have been made with and without a passenger. Capt. Felix, who flies a Blériot, made his record when practising for a flight across the Alps. On the 4th ult., in France, Lieut. Biard started from Mourmelon with a passenger and attained a height of 2,000 meters (6,560 feet) over Sissonnes. The same day, in England, Oliver de Montalent reached 2,500 meters (8,200 feet) with a passenger. On the last day of the Chicago meet Lincoln Beachy broke the world's altitude record by climbing to a height of 3,548 meters (11,640 feet) in one hour and 48 minutes. He attained this great height in a Curtiss "headless" biplane, and thrilled the spectators by a daring descent in spirals after his gasoline was exhausted. Beachy's actual height above sea level was 12,296 feet.

Science

Prof. Tarr's Adventures in Alaska.—According to press dispatches, Prof. Ralph E. Tarr, of Cornell University, who has been studying Alaskan glaciers, lost all of his data and instruments when a skiff, in which he and his party were crossing the delta at Fairbanks, capsized.

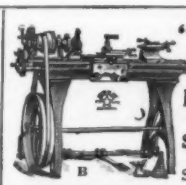
The German Antarctic Expedition.—The "Deutschland," the ship of the German Antarctic Expedition, which sailed from Germany in May, is expected to reach Buenos Aires in September. A leisurely voyage has been made over parts of the Atlantic that have hitherto been little explored in a scientific way, and oceanographic and physical observations have been carried on. Lieut. Filchner, the commander of the expedition, will join the ship at Buenos Aires, together with the last part of the equipment, including the ponies and dogs.

An International Museum of Speleology is to be founded at Adelsburg, Austria, near which lies the Adelsburg Grotto, the largest known cavern of Europe, the passages of which are five and one-half miles long. In this museum will be collected objects of all kinds relating to the study of subterranean botany, zoology, paleontology, anthropology, as well as geophysics, underground waters, etc. The site, which is in the famous Karst country, is well chosen for the purpose. The Austrian Ministry of Agriculture has contributed $6,000 to the undertaking.

A New Aerotechnic Institution.—Notwithstanding the fact that the word "aerotechnic" is not yet known to the dictionaries, institutions devoted to aerotechnic investigations are springing up in all parts of the world. The latest addition to the list is the Aerotechnic Institute, near Versailles, founded by M. Deutsch de la Meurthe, which, we learn from *Nature*, was formally opened on July 6. It has been endowed by its founder with a capital of $100,000 and a yearly income of $3,000, and is equipped with all apparatus necessary for experiments in aeronautics and aviation.

Why American Prairies are Treeless.—Prof. B. Shimek, of the State University of Iowa, has been studying this question in Iowa, where the treeless prairie originally covered more than seven-eighths of the total area of the State. He finds that the absence of trees is not due primarily to the soil or the topography, nor to such causes as prairie fires, the former abundance of the bison, etc., but is an effect of climate. Moreover, it is not due to a deficient rainfall, so much as to an excessive rate of evaporation. "The prairie areas are uniformly so situated that they are fully exposed to the factors which cause rapid evaporation, namely, the sun and the wind. During much of the year they may present conditions quite favorable to plant growth, but there are seasons and there are portions of the year, especially in midsummer, when evaporation and consequent dessication become so extreme that only those plants which are especially adapted to dry regions can survive."

Petrified Forest Giants.—Three petrified redwood trees, that have been pronounced the very largest in the world—that have thus far been discovered—have just been uncovered from the débris of the mountain-side—only a short distance from the famous Bohemian Club Grove, in Sonoma County, Cal. This point is near the little town of Occident. One of these prehistoric monsters—that make the pyramids of Egypt modern, by comparison, in their ages, measures 23 feet in diameter and is 350 feet in length! The other two petrified trees are 13 and 12 feet in diameter, respectively. The very largest petrified trees yet discovered, near Calistoga, Sonoma County, Cal., is only 12 feet in diameter. These three trees lie on a wooded hill pointing due north and south. The petrifaction is most remarkable—the grain of the wood, and in one of them the decaying heat, being very plainly discernible. Surrounding these petrified trees is standing a forest of very large redwoods. However, all of the standing trees are dead. The owner of the land on which these three great petrifactions lie, is now having the débris all cleared away, so as to fully expose the giant trunks, and an iron-railing will protect them.



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Electricity

Connecting England and Belgium by Telephone.—Arrangements have been made to lay a submarine telephone cable across the English Channel to connect England with Belgium. The length of the cable will be close to 50 miles. It will be provided with Pupin coils, and the construction will be similar to the cable now connecting France with England.

Wireless on Turkish Warships.—A wireless telegraph station is soon to be built at Constantinople. This will have a capacity of twenty kilowatts, and a radius of six hundred miles. In connection with this station, eleven Turkish warships will be equipped with apparatus covering a radius of four hundred miles, and seven others will be equipped with less powerful apparatus.

A Monorail Elevated Road for Mexico City.—A corporation is seeking permission to build an elevated railway in the Federal District, Mexico, on the plan of the one in Berlin, where the cars hang from a single rail. It is proposed to build a loop or circle within the city proper, by which passengers will be carried to within three blocks of almost any part of the capital, and from this loop branches will extend to the suburbs. The branch lines will run at ground level after leaving the city.

Wireless Telegraphy in Morocco.—A wireless telegraph station recently installed at Fez has greatly facilitated communication between the French government and its troops in Morocco. Messages are sent from the Eiffel Tower in Paris to Oran, Algeria, and there relayed to Fez. Another wireless telegraph station has been established by the French at Taourirt. This furnishes an alternate means of communication between Paris and Fez, viz., by submarine cable to Oran, by overland telegraph to Taourirt, and by wireless to Fez.

Electric Baling Presses.—It has been an almost universal practice to operate baling presses by hydraulic power. This has entailed considerable expense in localities where water pressure could not readily be obtained. It was recently suggested that electricity could be used to advantage for this purpose. Presses of this sort are now in operation. The table which carries the bale is suspended by means of four steel cables from the press head. The cables pass over several sheaves, to the winding drum which is connected to a reversible motor. By this means the table is pulled up toward the press head, compressing the bale. An automatic brake is provided for holding the bale under pressure.

Wireless in Military Aviation.—On July 29th the new wireless outfit of the French military aviators was used with entire success in an aeroplane manned by Adjutant Ménard, as pilot, and Capt. Brenot, according to a note in *Cosmos*. The aviators started from St. Cyr and flew over the region of Rambouillet. Keeping at an altitude of 1,600 feet, they had no difficulty in sending wireless messages to the Eiffel Tower, at an average distance of thirty miles, whence the messages were immediately transmitted to the Ministry of War. The apparatus used weighs, in all, 46 pounds. The spark is produced by a magneto operated by the motor of the aeroplane. The antenna, made of steel wire, can be rolled up when not in use. Experiments are now being made with a view to increasing the range of transmission.

Wireless "Lighthouses."—*La Nature* announces that the French Ministry of Public Works has decided to establish three "phares hertziens." The translation of this expression into English involves a contradiction; a "phare" is a lighthouse, but the new installations are to utilize Hertzian waves in lieu of light, and are designed to take the place of ordinary lighthouses in time of fog. One will be established at the lighthouse of Créach, Ushant; one on the island of Sein; and the third on the lightship "Le Havre," seven miles from the cape of La Hève. Each of these three "lighthouses" will send a characteristic signal. By the use of the Bellini-Tosi radio-compass vessels will be able to determine the direction from which the signal comes, and thus get their bearings in thick weather.

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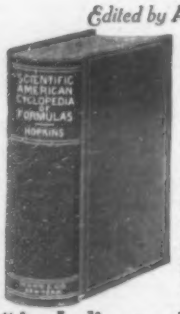

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Industrial Chemistry

The September Magazine Number of the SCIENTIFIC AMERICAN
Issue of September 16th, 1911

In the Scientific American for September 16th, the debt of humanity to the chemist will be set forth in simple language by men of the highest authority. No book of fairy tales ever told a story more amazing than that of modern industrial chemistry.

Just now one of the most puzzling of Nature's laboratory secrets has yielded to the patient research of the chemist. Rubber can actually be made artificially. But the product is more precious than diamonds. Will artificial rubber ever be a commercial possibility? This subject is discussed by Ira Remsen, President of Johns Hopkins University, in simple non-technical language.

A surprising laxity has been shown in this country in the matter of buying raw materials. Fortunately, we are waking up to the fact that enormous savings may be made if such materials are subjected to thorough tests. On this subject Dr. Charles F. McKenna, a leading expert, has prepared an interesting article.

America can point with pride to its achievements in electrochemistry. What the chemist can do with the aid of electric energy is told by William H. Walker, Professor of Chemistry at the Massachusetts Institute of Technology.

The opportunities for achievement offered by Industrial Chemistry will be discussed by Robert Kennedy Duncan, Professor of Industrial Chemistry at the Universities of Pittsburgh and Kansas. He will also give valuable advice to young men who wish to enter this field.

Dr. Allan Rogers, of Pratt Institute, is going to explain how he trains men to become foremen in works employing chemical processes, thus making for an intelligent cooperation with the expert chemist.

The familiar platinum sponge igniter for gas jets represents one of the infinitely numerous examples of so-called contact action of catalysis. Of the significance of this phenomenon and the mystery still surrounding it, which science has as yet been unable to dispel, Mr. A. J. Lotka writes in a specially prepared article.